EFFECT OF SEPTOPLASTY ON ALLERGIC RHINITIS

Dissertation submitted to

The Tamil Nadu Dr.M.G.R. Medical University

In partial fulfilment

Of the requirements for the award of the degree

M.S. BRANCH - IV

(OTO-RHINO-LARYNGOLOGY)

THE TAMILNADU

DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI, TAMILNADU

MAY 2018

CERTIFICATE I

This is to certify that the dissertation entitled **"EFFECT OF SEPTOPLASTY ON ALLERGIC RHINITIS"** is a bonafide record of work done by **Dr.N.RAGHURAM** in the Department of Otorhinolaryngology, Madurai medical college and Govt. Rajaji hospital, Madurai in partial fulfilment of the requirements for the award of the degree of **M.S. Branch IV (Otorhinolaryngology)** under my guidance and supervision during the academic period 2016-18.

I have great pleasure in forwarding the dissertation to The Tamil Nadu Dr. M.G.R. medical university.

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MADURAI MEDICAL COLLEGE AND

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This is to certify that this dissertation entitled **"EFFECT OF SEPTOPLASTY ON ALLERGIC RHINITIS"** is a bonafide dissertation work done by **Dr.N. RAGHURAM** in partial fulfillment of the requirement for the degree of M.S Branch - IV (OTO – RHINO - LARYNGOLOGY) under the guidance of **PROF.DR.N.DHINAKARAN, M.S. ENT.,** Professor, Department of Otorhinolaryngology.

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CERTIFICATE - II

This is to certify that this dissertation work titled "**Effect of septoplasty on allergic rhinitis**" of the candidate **Dr. N. RAGHURAM** with registration Number 221614102 for the award of degree of **M.S.** Branch IV in the branch of **Otorhinolaryngology**.

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I, **Dr.N.RAGHURAM**, solemnly declare that the dissertation entitled **"EFFECT OF SEPTOPLASTY ON ALLERGIC RHINITIS"** is a bonafide record of work done by me during the period of June 2016 – September 2017 at Madurai medical college and Govt. Rajaji hospital, Madurai.

This dissertation is submitted to the Tamil Nadu Dr.M.G.R. Medical University for the examinations to be held in April 2018 in partial fulfilments of the requirements for the award of M.S.Branch IV (Otorhinolaryngology). I have not submitted this dissertation work previously for the award of any degree or diploma from any other University.

Date:

Place: Madurai **Dr.N. RAGHURAM**

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In days, when acknowledgements have become more of custom than thanks giving, I would like to dedicate this work to people who have helped me in completing this study.

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N. RAGHURAM

ABSTRACT

OBJECTIVES

1. Evaluate the improvement in nasal obstruction following septoplasty in allergic rhinitis patients with associated deviated nasal septum using *Nasal Obstruction Symptom Evaluation (NOSE) Scale* and measure the extent to which this outcome is affected by allergic rhinitis status
2. To clarify whether patients with DNS and AR benefit from septoplasty
3. Evaluate the effect of septoplasty on the clinical course of allergic rhinitis and improvement in quality of life by comparing Allergic Rhinitis Control Test Questionnaire (ARCT)

STUDY DESIGN

A prospective study with consecutive sampling of all allergic rhinitis patients with symptomatic deviated nasal septum undergoing conventional septoplasty during the study period.

METHODS

All participants were assessed the severity of their symptoms based on a Nasal Obstruction Symptom Evaluation (NOSE) Scale prior to and a month following septoplasty. Patients were divided into subgroups according to ARIA guidelines of allergic status, comparisons were made. A five item Allergic Rhinitis Control Test (ARCT) questionnaire was given to allergic patients according to ARIA 2007 guidelines who underwent septoplasty prior to surgery and at the end of two months following surgery. Improvement in the allergic status following surgery was evaluated.

RESULTS

The mean decrease in NOSE score following septoplasty overall was (pre-operative 16.03, postoperative 9.58, $p<0.001$) analysed to be statistically significant (significant at 1% level, 99% CI). This clearly shows that in allergic patients with deviated nasal septum, irrespective of the allergic status septoplasty significantly improves the nasal obstruction as shown by the decrease in NOSE score to a statistically significant extent.

ARCT scores were recorded pre operatively and at the end of two months post operatively and results were analysed. Pre operative score was

(mean 12.77 ± SD 1.024) and the post operative score (mean 21.8 ± SD 0.914) with p value < 0.001, significant statistically at 1% level, 99 % CI. This clearly shows that in allergic rhinitis patients with symptomatic deviated nasal septum, septoplasty improves the quality of life pertaining to allergy to a statistically significant extent.

CONCLUSION

The present study suggests that in allergic rhinitis patients with symptomatic deviated nasal septum or in other words septoplasty performed in allergic rhinitis with coexistent deviated nasal septum not only improves the nasal obstruction significantly, but also there is a remarkable improvement in the control of allergic rhinitis following surgery.

Keywords: Septoplasty, Deviated nasal septum(DNS), Allergic rhinitis(AR), NOSE score, ARCT score

LIST OF ABBREVIATIONS

AR	Allergic rhinitis
DNS	Deviated nasal septum
NOSE scale	Nasal Obstruction Symptom Evaluation scale
ARIA	Allergic Rhinitis and its Impact on Asthma
AEC	Absolute Eosinophil count
CT PNS	Computed Tomography of Paranasal Sinuses
ARCT Questionnaire	Allergic Rhinitis Control test Questionnaire
POD	Post Operative Day

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INTRODUCTION

Difficulty in nasal breathing is probably the most common complaint in rhinological practice. Among the major causes are Deviated nasal septum (DNS) and Allergic rhinitis (AR). Treatment of symptomatic DNS is surgical with high success rate, in terms of patient satisfaction, particularly if the deformity is localised in the caudal septal end or the valve area [1,2]. Treatment of AR is a much complex issue, including medication, avoidance of causative allergen, desensitisation and the use of a variety of surgical techniques, which mainly aim at the reduction of the size of the inferior turbinates[3,4].

When deciding on the best therapeutic strategy for patients with nasal pathology one must have a tool for the assessment of subjective symptoms. The Nasal Obstruction Symptom Evaluation(NOSE) Scale is a disease -specific quality of life instrument used for use in nasal obstruction, developed by *Stewart et al*[5].

The co-existence of DNS and AR often present a therapeutic challenge for the physician. The aim of this study is to assess the outcome of septoplasty using self- assessment scale and to examine the extent to which this outcome is affected by allergic rhinitis status[6] and to evaluate the effect of septoplasty on the clinical course of allergic rhinitis and improvement in quality of life by comparing Allergic Rhinitis Control Test Questionnaire (ARCT)[7,8].

AIM AND OBJECTIVES

4. Evaluate the improvement in nasal obstruction following septoplasty in allergic rhinitis patients with associated deviated nasal septum using *Nasal Obstruction Symptom Evaluation (NOSE) Scale*[6]

5. To clarify whether patients with DNS and AR benefit from septoplasty

6. Evaluate the effect of septoplasty on the clinical course of allergic rhinitis and improvement in quality of life by comparing Allergic Rhinitis Control Test Questionnaire (ARCT)[7,8].

REVIEW OF LITERATURE

ANATOMY AND EMBRYOLOGY OF THE NOSE

Development of the nasal airway begins during the fourth week of gestation. Collections of neural crest cells undergo proliferation and form the nasal placodes[9,10] . The nasal septum develops as a down growth from the merged medial nasal processes and the nasofrontal process, thus defining the right and left nasal cavities. The nasal septum and the palatine processes begin to fuse anteriorly during the ninth week, and fusion is completed posteriorly by the twelfth week[9].

The cartilaginous framework of the nose develops from three paired mesenchymal condensations in both the medial and lateral nasal swellings. Part of this cartilage begins to ossify, thereby forming the membranous bone encasing the vomer and perpendicular cartilaginous plates. The perpendicular plate of the ethmoid and the nasal bones do not completely ossify until puberty [9]. Injury to the nose in the young child or teenager may not elicit a true fracture, but it may instead create growth changes in this transitioning tissue, which may ultimately result in a deviated posterior bony septum or even the formation of a spur.

The nasal septum has functional and aesthetic significance. The septum is the main support structure of the external nose[11]. It divides the nose into two cavities, regulates airflow through the nose, and supports the mucosal lining of the nasal cavities[11]. Where once the lining was afforded greater significance, now both the mucosa and the cartilage are recognized as co-dependent and necessary.

The bony components of the septum include the nasal crest of the palatine bone, the nasal crest of the maxilla and premaxilla, the vomer, the perpendicular plate of the ethmoid, the nasal crest of the frontal bone, and the spine of the paired nasal bones. The anterior septum is composed of the quadrilateral cartilage, with its caudal-most projection extending beyond the nasal spine (figure1). Because of the complicated embryologic development of the septum, any one of a number of arrangements of the bone and cartilage contributions may be encountered during surgery.

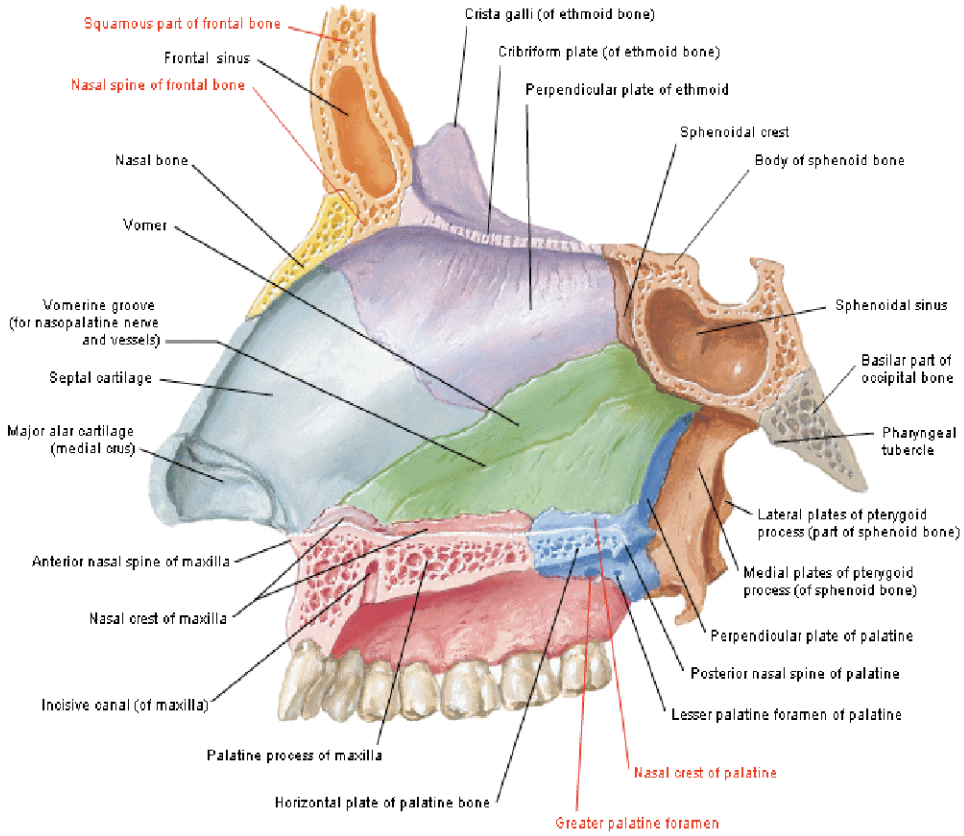


Figure 1:ANATOMY OF NASAL SEPTUM

Turbinates

The lateral nasal wall is composed of the laminae papyracea of the lacrimal bone, portions of the ethmoid bone, and the inferior and middle nasal conchae or turbinates (figure 2). The turbinate bones develop from a cartilage ossification center during the fifth intrauterine month. The inferior, middle, and superior turbinates are composed of a thin bone for structural support and covered by an adherent mucoperiosteum. Stratified squamous epithelium is found on the anterior tip of the inferior turbinate,

whereas pseudostratified ciliated columnar respiratory epithelium covers all other surfaces. The continually beating ciliated mucosa provides constant motion to the mucous blanket within the nose; this blanket acts as a cleaning and filtering system for the upper respiratory tract and also helps to maintain the moisture content within the nose. The turbinates maximize the effective intranasal surface area and rapidly humidify and warm the inspired air[12].

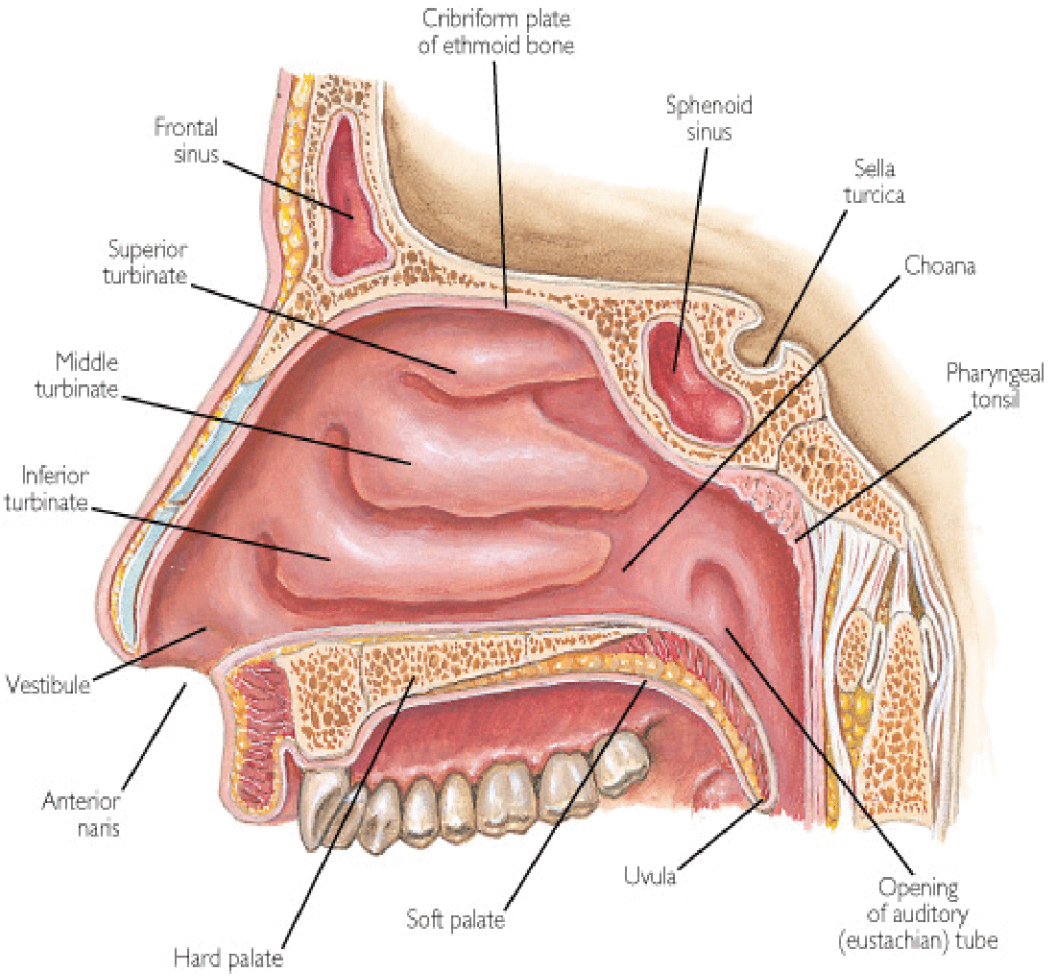


Figure 2: ANATOMY OF LATERAL WALL OF NOSE

Blood Supply and Innervations

Blood supply and innervations of the nasal septum are delivered within the mucoperiosteal and mucoperichondrial linings. The arterial blood supply originates from the ophthalmic branch of the internal carotid artery and the maxillary and facial branches of the external carotid artery. Blood to the upper nasal septum is supplied by anastomoses of the anterior and posterior ethmoid arteries, which originate from the ophthalmic branch. The external carotid artery contributes via a major branch of the sphenopalatine artery that perfuses the posterior and inferior septum. The columella and caudal septum receive blood supply from the septal branch of the superior labial artery (figure 3). The septal mucosa itself contains complex arteriovenous anastomoses and venous sinusoids that can become engorged or constricted via neural or extrinsic pathways.

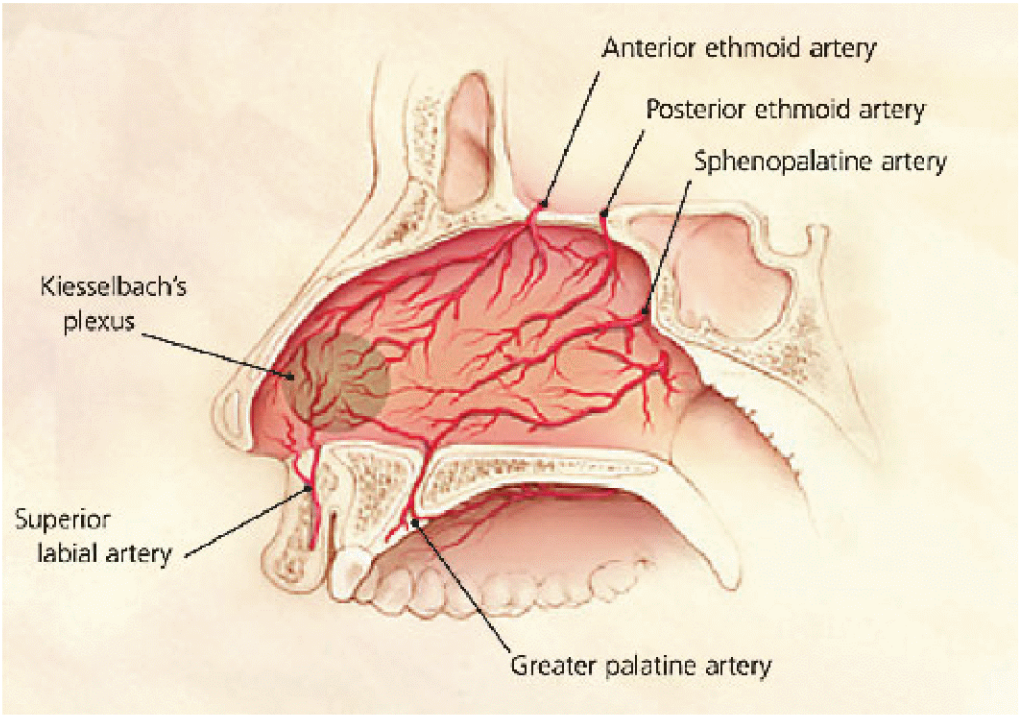


Figure 3: DEPICTION OF THE BLOOD SUPPLY TO THE NASAL SEPTUM

A variably located incisive artery and its associated neural fibers are found at the superior border of the vomer. This neurovascular bundle may be encountered when trimming a badly deviated maxillary crest or when elevating periosteum when a nasal floor approach is needed. Control of bleeding from this site may be obtained by infiltrating the incisive foramen from below, "plugging" the site from above, or carefully using suction Bovie cautery. After resection or trimming of the maxillary crest or work on the nasal spine, patients may complain of numbness or pain of the central incisors or of the mucosa of the hard palate just posterior to the

incisors. This lack of sensation or complaint of pain is generally a short-lived phenomenon.

Innervations of the nasal mucosa include both autonomic and sensory components. The autonomic nervous system regulates the degree of vascular tone, turbinate congestion, and nasal secretions present in the nose at any given time. Presynaptic parasympathetic fibers travel along the facial nerve and continue as the greater superficial petrosal nerve at the geniculate ganglion. These fibers then join the deep petrosal nerve to form the vidian nerve. Within the vidian nerve, the fibers travel to the sphenopalatine ganglion and synapse with the postganglionic neurons before innervating the nasal mucosa. Postsynaptic sympathetic fibers pass through the sphenopalatine ganglion and terminate in the nasal mucosa. The first and second divisions of the trigeminal nerve supply sensory innervation to the nasal mucosa. Trigeminal nerve fibers also pass through the sphenopalatine ganglion and transmit sensations of pain, temperature, and touch.

NASAL OBSTRUCTION

Thorough examination and visual inspection of the patient who complains of nasal airway obstruction are essential for diagnosis and treatment planning. Visual assessment of the external appearance of the nose is of utmost importance. This examination initially focuses on the size, shape, symmetry, and straightness of the nose; one should document the size of nostril openings, the thickness of the alae, and the width of the columella. Columellar widening may be seen with caudal septal cartilage deviation, splaying of the medial crura, or excess soft tissue

Anterior rhinoscopy allows for visualization of the septum, the turbinates, and the nasal valve—the most narrow area of the airway bordered by the septum, the upper lateral cartilage, and the anterior aspect of the inferior turbinate. Examination of the patient should be performed before and after decongestion to fully evaluate the contributing factors to nasal obstruction and to allow for a complete nasal examination. A large swollen turbinate can often obscure a posterior nasal spur. There should be no surprises at the time of surgery as a result of inadequate preoperative problem recognition. Nasal endoscopy with a rigid endoscope of the sinonasal region can be carried out to fully evaluate intranasal structures and assess for polyps, masses, and adenoidal size. The 4-mm 30-degree endoscope provides an excellent view.

External evaluation of the patient's nose should include performance of the Cottle maneuver, in which lateral distraction of the nasal valve is performed (figure 4). This maneuver may improve the sensation of nasal obstruction in cases of nasal valve collapse or anterior septal deviation. A positive Cottle maneuver may suggest nasal valve compromise, [13] but it is not always a reliable indicator, with many false positives seen. Lateralizing the upper lateral cartilage (ULC) and then assessing for improvement in the obstruction sensation may provide a more accurate assessment of the nasal valve.

Figure 4: COTTLE TEST

Deviated Nasal Septum

Deviation of the nasal septum is a common cause of unilateral nasal airway obstruction and may follow nasal and midfacial trauma. Trauma during birth, including forceps placement or passage through a narrow pelvic canal, can cause injury that may lead to early septal deviation or to deviation that is not evident until the more active growth phase of puberty. Minor trauma sustained early in life can be easily overlooked and frequently causes micro fractures of the septal cartilage; healing of these micro fractures leads to bending of the cartilage away from the side of injury. When this occurs early in life, it may lead to asymmetric growth of the entire nasal structure as a result of chondrocyte growth interruption. Patients with unilateral septal deviation most often complain of nasal obstruction on the contralateral side, a phenomenon called "paradoxic nasal obstruction"[14]. Patients are confused when the physician explains that the nasal passage through which the patient feels airflow moves most freely is actually the smaller of the two sides. Decongesting the nose and then testing airflow through each nostril separately or showing the patient an endoscopic photograph of each passage can help the patient to accept the explanation and understand the true problem.

AETIOLOGY

1. Compression / Birth Trauma [15]

2. Developmental error

3. Racial and hereditary factors

TYPES

1. Anterior dislocation

2. C or S shaped deformity

3. Spurs

4. Thickening (figure 5)

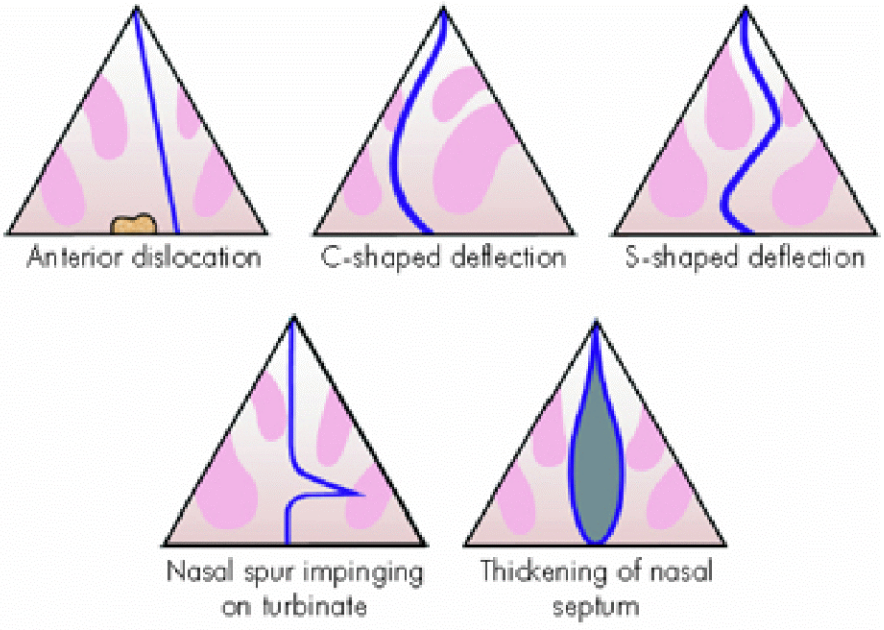


Figure 5: TYPES OF DEVIATED NASAL SEPTUM

CLINICAL FEATURES

1. Nasal obstruction

2. Headache

3. Sinusitis

4. Epistaxis

5. Anosmia

6. External nasal deformity

7. Middle ear infection

TREATMENT

1. Submucousal resection

2. Septoplasty

Measurement of Obstruction

Acoustic rhinometry, which is an easy test for patients to tolerate and for staff to perform, provides a minimally invasive, convenient, accurate, and expeditious method of measuring dimensions of the nasal airway[1,17,18,19].

The equipment delivers sound waves to the nasal cavity and then measures their reflection (figure 6); the resulting wave is called a rhinogram. The nasal valve causes the first dip in the rhinogram, and the second is caused by the anterior tips of the inferior and middle turbinates (figure 7). Acoustic rhinometric assessment of the valve can be used to determine whether valve surgery may be helpful for the correction of the patients' complaint of nasal airway obstruction.

Figure 6: ACOUSTIC RHINOMETER

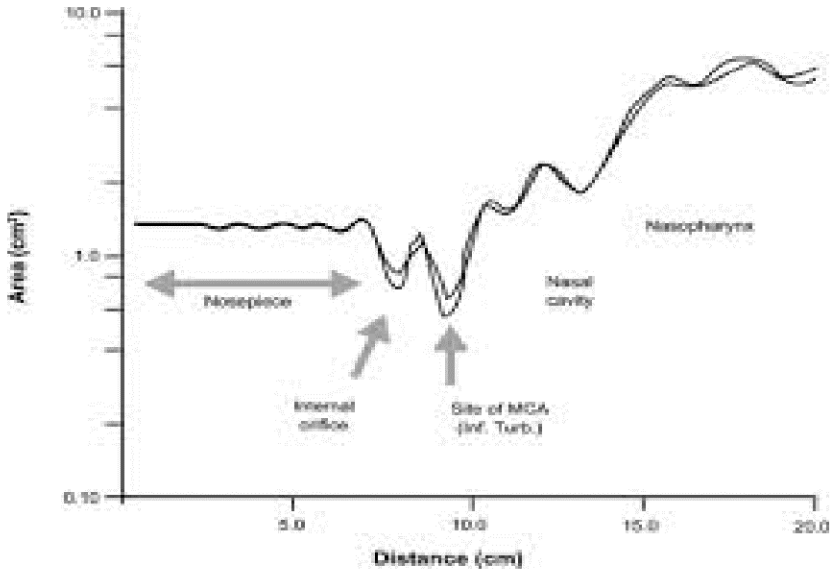


Figure 7: RHINOGRAM GENERATED BY THE ACOUSTIC RHINOMETER. [First dip caused by nasal valve and the second dip (minimal cross sectional area) caused by the anterior ends of inferior and middle turbinates]

Airflow rhinomanometry, a second assessment tool, is a dynamic test of resistance to nasal airflow both before and after vasoconstriction[19]. Reproducible data can be obtained to evaluate anatomic abnormalities and document surgical or medical management outcomes[16]. Although rhinomanometry is very sensitive, there does exist some margin of error that is based in test administration. Rhinomanometry provides a numeric value that indicates how hard it is to breathe through the nose. Breathing resistance of the combined cavities of the adult nose at rest greater than 3 cm H_2O/L/s indicates obstruction[16].

SEPTOPLASTY TECHNIQUE - EVOLUTION

The closed septal redisplacement methods described and advocated by Adams [20] and Asch [21] in the late 1800s relied on blunt force and attempts to disrupt cartilage attachments and inherent properties. Freer [22] goes so far as to suggest that the technique involves the "…temptation to use violence to overcome the resiliency of the septum." Asch [21] was careful to advocate this method only for correction of the cartilaginous deviations and never for correction of vomer or ethmoidal bone crookedness

Krieg [24] described a technique of mucosal resection in which the deflected cartilaginous segment, along with overlying mucosa, was removed in its entirety; this left a large perforation and caused other complications that surely outweighed any temporary benefits. Freer [22] gives credit to American researcher and surgeon E.F. Ingals in 1882 for the description of mucosal flap elevation and removal of a triangular portion of the quadrilateral cartilage. This was the so-called "window resection". Krieg [23] described resection of the entire deflected cartilage segment and used a slightly different mucosal incision. Boenninghaus [24] suggested that resection be continued more posteriorly into the vomer and perpendicular plate of the ethmoid, if necessary, for definitive airway straightening.

Overall, little emphasis was placed on the potential structural support that the septum afforded. In fact, many, including Freer [22] and Fomon and colleagues[25], felt that the overlying mucosa was the only physiologically important structure within. Saddling of the nose was blamed not on cartilage resection but rather on the cicatricial forces of healing.

SEPTOPLASTY TODAY

Until the 1960s, submucous septal resection as promoted by Freer [22] and Killian [26] was standard practice. With this technique a more or less straight septum was obtained in the areas where the septal skeleton was resected. Two strips of cartilage were left behind, one to maintain the dorsum and the other to keep the tip and columella in place. Despite these strips, scar formation and subsequent contraction of the fibrous tissues in the resected part of the septal cartilage were a frequent cause of saddling and retraction of the columella. Septal perforations were a common complication, in part due to drying of the opposing mucoperichondrium adjacent to the incision. Another drawback of this technique was that correction of pathology in the dorsal, caudal, inferior and posterior parts of the septum was not possible.

In 1963, Cottle and van Dishoeck gave a course on nasal surgery in Leiden that laid the foundations for contemporary nasal surgery. The basic concepts were to reconstruct instead of resect and to deal with function and cosmetics in one procedure[27]. In the surgeon's pursuit to reduce trauma, many of the techniques promoted by Cottle have evolved into more delicate procedures. Furthermore, the open approach, as promoted by Sercer [28] and Padovan [29] and reintroduced by Goodman[30] and others, found its place in nasal surgery. It gives access to the tip dorsum and bony pyramid, but is not the first choice for access to the septum.

In the surgical procedure, there are six phases: (1) gaining access to the septum; (2) correction of pathology; (3) removing pathology; (4) shaping removed cartilage and bone; (5) reconstruction of the septum; and (6) stabilizing the septum.

GAINING ACCESS TO THE SEPTUM

Hemitransfixion is the basic incision used to gain access to the septum. In contrast to the transfixion, the incision is not made in the membranous septum but over the cartilaginous septum parallel to the caudal edge, approximately 2mm posterior to the edge (figure 8). Then, between the cartilage and the perichondrium an anterior tunnel is made on both sides. If necessary, inferior tunnels complete the access

to the septum. In making the inferior tunnels, there is a posterior and anterior approach. The latter is called the maxilla-premaxilla approach. It is more complicated and risks damage to the incisive nerve. However, it has the advantage that it can be used in cases where it is difficult to make an anterior tunnel. To prevent atrophy of the mucous membranes, the blood vessels must be preserved by advancing in a submucoperichondrial or subperiosteal direction. After tunnelling, the inferior part of the septum can be detached from the anterior nasal spine, premaxilla and the maxillary crest. Next an incision between the posterior part of the septal cartilage and the bony septum can be made. This is called a 'posterior chondrotomy'. After these procedures, the septum can be moved aside, rather like a swinging door. This swinging-door technique gives access to the posterior or bony septum.

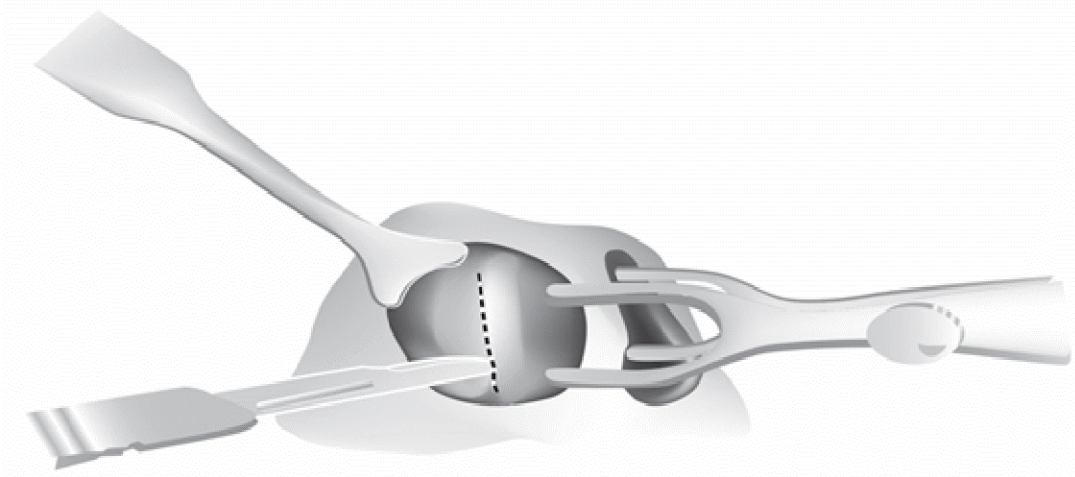


Figure 8: HEMITRANSFIXION INCISION

CORRECTION OF SEPTAL PATHOLOGY

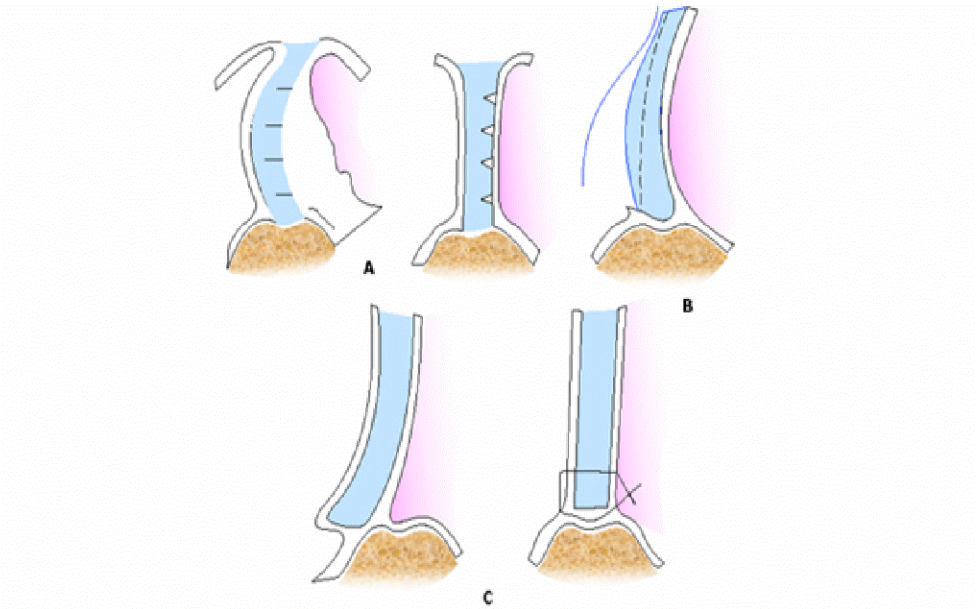
A deviation due to tension in the septum, or an inferior edge that has slid along the spine or a maxillary crest, can be corrected by removing an inferior cartilaginous strip. Dislocations due to fractures can be dealt with intraseptally by mobilization or resection of parts of the septum.

REMOVING SEPTAL PATHOLOGY

More severe deformities require resection of parts of the septum and sometimes of the septal cartilage as a whole. After that, the resected area should be reconstructed preferably with the autologous materials already removed. When these are not available, the patient's ear or rib cartilage might be an alternative. The extent to which septal cartilage and bone can be removed is only limited by the surgeon's abilities to reconstruct the septum afterwards. Nevertheless, resection should be restricted as much as possible to avoid trauma and complications. Duplications, spines, crests and convexities are the main indications for a resection. Any removed material is saved for the reconstruction later. Straight parts are carefully preserved as a whole, to provide large struts necessary to give support to the dorsum, tip and columella.

RESHAPING CARTILAGE AND BONE

Cartilage does not heal. Fractures and defects will be filled up by connective tissue. Retraction of connective tissue can alter a good result immediately after surgery into a poor result after some months to a year. The dynamics of the healing process must be understood to enable appropriate correction of the septum. Reshaping should be done with as little trauma as possible, with maximum preservation of straight apportions of the septum (figure 9).



Septal cartilage is straightened by scoring the cartilage on the concave side to remove interlocked cartilage stresses (A), or by shaving the convex side of cartilage (B). Dislocated septal cartilage can be replaced in the maxillary groove or on the anterior nasal spine by excision of the cartilage along the floor of nose and fixing it with a suture (C).

Figure 9: SEPTOPLASTY PROCEDURE

RECONSTRUCTION OF THE SEPTUM

Only the patient's own septal cartilage meets the requirements for optimum reconstruction. Other materials such as ear or rib cartilage can be used as a substitute, but are second choice. The use of cartilage from a tissue bank carries the risk of transmitting infectious agents, such as prions and viruses, and requires a god understanding of the mechanical properties of the donor material.[31,32] For these reasons, it is wise not to use these materials if it can be avoided. A strong strip of cartilage under the cartilaginous dorsum should prevent a saddle nose. Tip projection is preserved and retraction of the columella is prevented by a strip of cartilage in the caudal part of the septum. Of course it is best to leave the patient's own cartilage in place in these areas when that is feasible. If not, careful reconstruction is imperative. A mosaic of cartilage pieces can fill up a defect in the center of the cartilaginous septum to prevent retraction by fibrous tissues of the cartilage supporting the dorsum and columella, which is a long-term complication after resection of the center of the septal cartilage.

STABILIZING THE SEPTUM

There are different ways to keep the septal skeleton in place during healing. First of all, a dressing is put into the nose to bring the mucousa together. In this way the septum is squeezed between the blades holding the skeleton in place. Mattress sutures (figure 10) have the same effect. Splinting by so called nasal splints is effective in stabilizing reconstructions that are more extensive. They have the advantage that they can stay in nose and allow the patient to breathe through the nose, thus prolonging the time the septum is supported. It should be noted that nasal packs are very uncomfortable to the patient. Furthermore, there are number of suture techniques to fixate the reconstructed parts. Techniques vary, according to the stability of the septum and the surgeon's preferences.

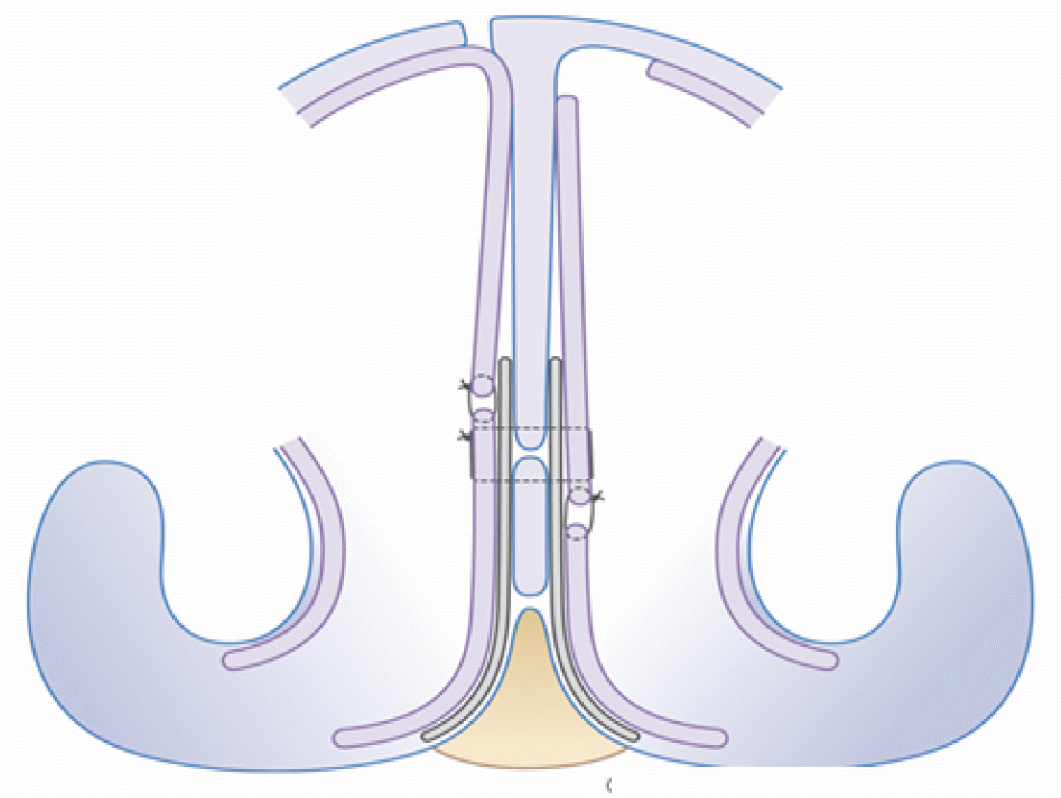


Figure 10: MATRESS SUTURES

COMPLICATIONS OF SEPTOPLASTY

The most common septoplasty complication is persistence in the subjective complaint of nasal obstruction. [33,34]. A septal hematoma (figure 11) may be seen when either a quilting stitch is not used or nasal packing is not placed. Septal perforations (figure 12) resulting from unrepaired contiguous septal mucoperichondrial fenestrations or failure to reskeletonize the mucoperichondrial envelope at the completion of the septal resection maneuver is possible. Nasal shape changes (e.g., tip ptosis, dorsal nasal saddling) may result from over-resection of the caudal septum

or the loss of dorsal nasal support. Mild postoperative oozing is very common and not necessarily a complication during the early phase but rather something to be expected. Some patients may experience significant bleeding postoperatively, and this is usually seen in those who also underwent inferior turbinate resection.

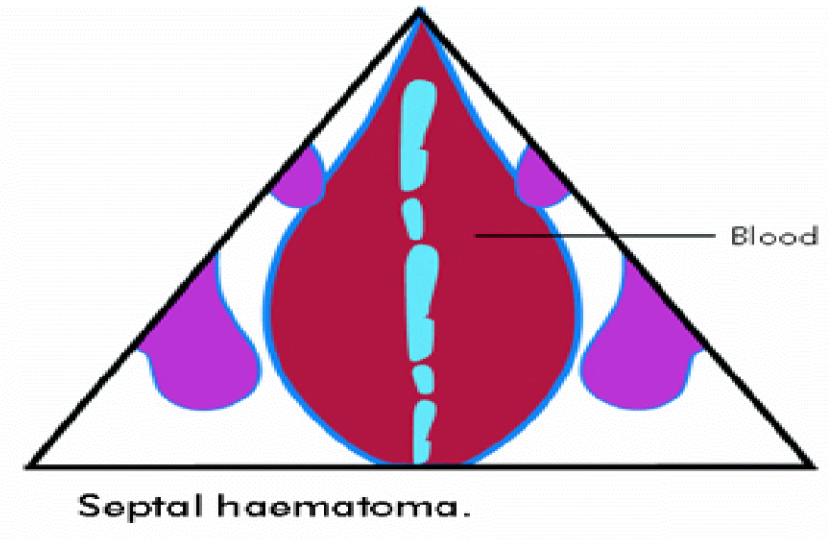


Figure 11: SEPTAL HAEMATOMA

Figure 12: SEPTAL PERFORATION

CONCLUSION

Nasal obstruction is a subjective sensation that is unique to each individual and that variably correlates with anatomic pathology. The structural support that the septum affords must be preserved and is the reason that surgeons have moved from aggressive resection to preservation. The importance of an intact L-strut, an adequately supported nasal valve, and relief of obstruction is recognized. A good septoplasty with attention to all of these areas is a prerequisite for not only a functional nose, but a straight nose as well [35].

ALLERGIC RHINITIS

"Allergy" requires repeated exposures to an antigen for the formation of antibodies. In the case of respiratory allergy, this involves presentation of the relevant antigenic material from an allergen by an antigen-presenting cell (macrophage) to B lymphocytes. Each person's B cells are capable of displaying millions of uniquely configured antibody sites. These cells, under the influence of various cytokines (generated in part by T lymphocytes), produce allergen-specific immunoglobulin E (IgE). It has been estimated that a minimum of five such antigen exposures are required to produce sensitization[36].

In type I hypersensitivity, an antigen bridges two adjacent allergen-specific IgE molecules attached to a mast cell or basophil, resulting in a dissolution of the cell and liberation of both preformed (e.g., histamine) and newly formed (e.g., prostaglandins, leukotrienes) mediators of inflammation (figure 13). These produce glandular stimulation, vasodilation, increased vascular permeability, and irritation, which are responsible for the typical symptoms of itching, sneezing, rhinorrhea and congestion. The acute reaction takes place within a few minutes of the antigen-antibody reaction. Approximately 4 to 6 hours later, under the influence of various cells and cytokines, a late-phase reaction occurs that results in a recrudescence of symptoms.

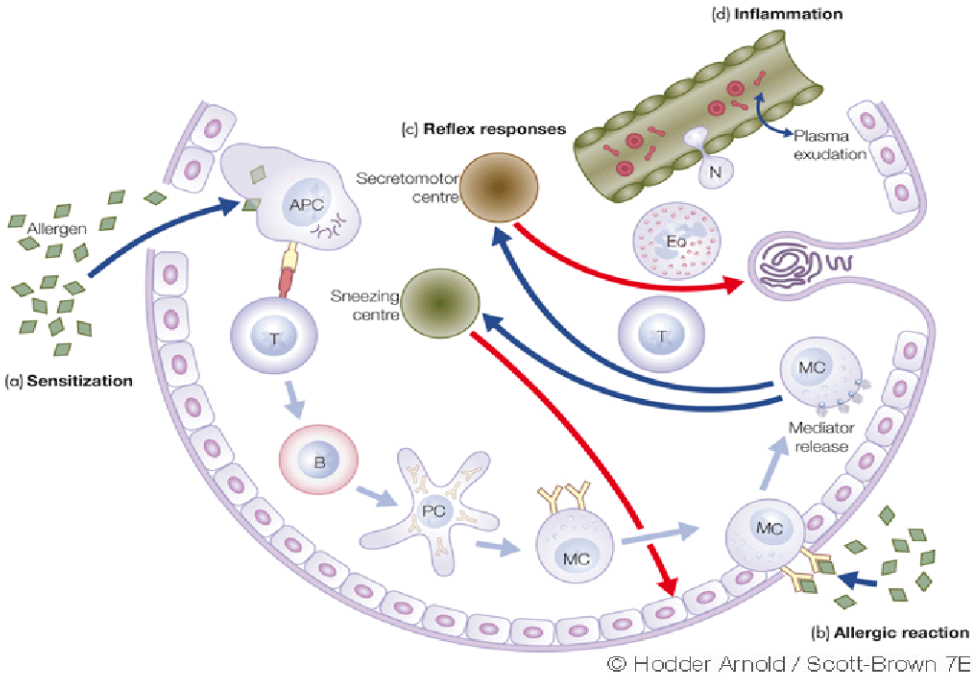


Figure 13: PATHOPHYSIOLOGY OF ALLERGIC RHINITIS

OFFENDERS AND SEASONS

The allergens that generally produce allergic rhinitis have traditionally been classed as "seasonal" or "perennial" offenders. The former group consists primarily of pollens (grasses, weeds, trees), whereas the latter includes dust mites, molds, animal danders, and cockroaches. In addition to these, some patients demonstrate allergy to other unusual plants, animals, and fibers.

SYMPTOMS AND SIGNS OF ALLERGIC RHINITIS

The characteristic symptoms and signs of allergic rhinitis are easily understood if one keeps in mind the effects of the mediators released by mast cells and basophils as a result of a Gell and Coombs type I reaction. These include glandular stimulation, vasodilation, increased vascular permeability, and irritation, changes that are responsible for the typical symptoms of itching, sneezing, rhinorrhea, and nasal congestion.

An allergy history includes information about the seasons or circumstances that trigger symptoms, the types of symptoms that predominate the results of any previous allergy testing, and the effect of previous treatment, as well as the presence of complicating problems such as sinusitis, asthma, otitis media, and so forth. Although an allergic history begins at the time of the first visit, it is a constantly evolving process.

The signs of allergic rhinitis include the "allergic salute", which is characterized as follows: the hand lifts the nasal tip to respond to itching temporarily opening the airway, a transverse nasal crease seems to be caused by repetition of this maneuver, and facial grimacing and twitching are present because of itching membranes. The nasal turbinates are generally pale to bluish. Another characteristic sign is clear rhinorrhea. The presence of polyps does not necessarily indicate allergy[37]. Obligate

mouth-breathing might result in a typical open-mouthed countenance and "adenoid facies"[38].

ADJUNCTIVE TESTS

A number of adjunctive tests have traditionally been used to confirm the clinical diagnosis of allergic rhinitis. Among these are a differential count of peripheral leukocytes or the examination of smears of nasal secretions for the presence of eosinophils[39]. These measures have generally given way to specific diagnostic techniques that measure levels of IgE for various antigens.

The diagnosis of allergic rhinitis is made by history, and the novice rhinologist must realize that the presence of a positive test is just that: a positive test. Clinical correlation between the patient's symptoms and any postulated sensitivity to the incriminated antigens is necessary to confirm a diagnosis of clinically relevant "allergy."

Confirmatory Skin Testing for Allergy

The "gold standard" of allergy testing is generally considered to be skin testing. The basis of this procedure is the reaction between antigen and sensitized mast cells in the skin, producing the classic wheal and flare skin response. This reaction begins with an acute phase that starts within 2 to 5 minutes, reaches a maximum at 10 to 20 minutes, and is characterized

by vasodilation (producing erythema) and local edema (producing a wheal). It might be followed by a late phase, with further whealing and induration occurring 4 to 6 hours or more lately.

A number of factors affect skin tests. In addition to the volume and potency of antigen introduced, the degree of sensitization of cutaneous mast cells and reactivity of the skin also are modified by drugs, the age and race of the patient, the area of the body injected, the distance separating individual skin tests, and the time of day of testing[40]. Skin test responses are suppressed by antihistamines. All forms of antihistamines must be avoided for at least 48 to 72 hours before skin testing. Although tricyclic antidepressants are no longer commonly used, patients taking them must omit them for up to 96 hours before skin testing, because they suppress whealing responses. Decongestants, systemic steroids, and leukotriene modifiers do not significantly affect skin test results.

Skin tests are generally classified as epicutaneous or intracutaneous. The former group includes scratch tests and prick-puncture testing, and the latter group includes both single-dilution and multiple-dilution intradermal tests.

Confirmatory In Vitro Testing for Allergy

Skin testing for allergy is subject to a number of drawbacks, including the potential for production of a significant reaction and the discomfort, however minimal, associated with the procedure. These drawbacks have led to a continued search for other diagnostic methods. Shortly after the characterization of IgE as the sensitizing factor in allergy, a radioimmunoassay was developed that could detect specific IgE antibodies in serum. This assay, which was called the radioallergosorbent test (RAST), evolved significantly over the years that followed and has become an important tool in the diagnosis of inhalant allergy[41].

Although numerous variations of technology exist, the basic principle of the in vitro analysis of allergen-specific IgE is a "sandwich" technique in which allergens on a solid phase (such as a paper disk) are allowed to react with serum from the patient. Any IgE antibodies to that allergen that are present bind to the solid phase. This resultant complex is then incubated with radiolabeled rabbit antibodies to human IgE. After washing, the amount of radioactivity in the resulting sandwich of allergen/antibody/anti-IgE/radioactive marker on the disk is measured with a gamma counter, and the amount of antibody present is calculated.

Along with the popularization of the allergen-specific RAST, the measurement of total IgE has been advocated as a means of diagnosing the

presence of allergy. However, it has become apparent that in some instances a high total IgE (>100 IU/mL) is not associated with true allergy, whereas in others a low total IgE might be present in patients with significant allergy. The measurement of total IgE might be useful in clarifying otherwise equivocal results but has little value when used alone to diagnose the presence of allergy. Modern technology exists for the assay of allergen-specific IgE for numerous antigens. However, as a general rule, an assay of 8 to 15 antigens is sufficient to adequately indicate the presence or absence of significant inhalant allergy[42]. Positive responses are followed by additional testing for other relevant antigens.

Management by Environmental Control

The best and most desirable management of allergy is avoidance when possible. Although this must often be supplemented by pharmacotherapy, and sometimes with immunotherapy, environmental control remains the most important component of this therapeutic triad.

Management by Pharmacotherapy

Antigens are not always avoidable, and immunotherapy modifies the allergic response but does not always afford protection from an overwhelming antigen exposure. Therefore, symptomatic management by

means of pharmacotherapy is required to some degree for every patient with allergic rhinitis.

Antihistamines

Antihistamines act to control the "wet" symptoms of allergic rhinitis, such as rhinorrhea, sneezing, and itching membranes. Examples of first-generation antihistamines include chlorpheniramine, brompheniramine, triprolidine, and diphenhydramine. Second-generation, or nonsedating, antihistamines generally have multiple actions, which often include direct effects on allergic mediators. Because they do not readily cross the blood-brain barrier, they either do not produce sedation or do so only in large doses. Their anticholinergic effects are much less pronounced, and they are free of tachyphylaxis. Second-generation antihistamines include loratadine, cetirizine, and acrivastine. Topical antihistamines have been developed, such as levocabastine and azelastine.

The newest antihistamines are metabolites and congeners of existing drugs, offering fewer potential side effects but with equal effectiveness[43]. The first such third-generation preparation to become available was fexofenadine, the active metabolite of terfenadine. The introduction of desloratadine, derived from loratadine, followed shortly thereafter. Tecastemizole (from astemizole) and levocetirizine (from cetirizine) are currently under active development. The benefits sought from these and

future antihistamines will be equal or superior potency, enhanced safety profiles, with enhanced onset of action and extended duration of activity.

Decongestants

Decongestants are alpha-adrenergic agonists that produce vasoconstriction in the turbinates, lessening nasal congestion. When topically applied for more than 5 to 7 days, they might produce a rebound rhinitis, and addiction to nose drops and sprays is a commonly encountered phenomenon in patients with chronic rhinitis. For the management of allergic rhinitis, decongestants are often combined with antihistamines.

Mast Cell Stabilizers

Cromolyn is most beneficial when used before an anticipated allergen exposure but must be administered at least four times daily for maximum effect. Patients with severe allergic rhinitis might not respond adequately to this medication, but it is an extremely safe and often effective initial therapeutic measure. Other topical mast cell stabilizers that remain in development for intranasal use include olopatadine, oxatomide, and quazolast.

Corticosteroids

Corticosteroid preparations are potent anti-inflammatory agents that do not prevent an antigen-antibody allergic reaction but diminish the effects of vasoactive kinins and other mediators by decreasing capillary permeability, stabilizing lysosomal membranes, blocking the action of migratory inhibitory factor, and directly affecting phospholipase. Systemically administered corticosteroids primarily affect the late-phase allergic reaction, whereas topical preparations also might act on the acute phase after pretreatment for a week or longer.

Systemic administration of corticosteroids must be done with the full realization of their potential for suppression of endogenous cortisol production, as well as their possible adverse effects on many organ systems. Significant hypothalamic-pituitary-adrenal suppression might occur after approximately 5 to 7 days of the daily administration of 20 to 30 mg of prednisone or its equivalent, or occur in up to 30 days with lower doses. Adrenal recovery might occur within 1 week of discontinuing short-term, high-dose therapy, whereas up to 1 year or more might be required after prolonged, high-dose therapy.

The popularization of topical nasal corticosteroid preparations (Fluticasone, Beclomethasone, Mometasone, etc.) during the past two decades has greatly diminished the systemic administration of these

preparations. The tendency has been for newer forms to require less frequent administration (improving patient compliance) and to have less likelihood of systemic effect (diminishing the possibility of complications associated with prolonged use at high doses).

Anticholinergics

Because rhinorrhea is such a prominent feature of allergic rhinitis, combination preparations that contain anticholinergic drugs were introduced many years ago. Unfortunately, many of these had a profound over drying effect, provoking nasal crusting and thickened nasal and sinus secretions. Only a few such preparations are still marketed (eg. ipratropium bromide), and these should be avoided if possible because of their potential side effects.

Leukotriene Modifiers

The original role of leukotriene modifiers (Zileuton, Montelukast, Zafirlukast) was in the treatment of asthma and polyposis (especially Samter's triad patients), and only recently have they been investigated as adjuncts to antihistamine and/or corticosteroid therapy or as stand-alone treatments for allergic rhinitis[44].

Management by Immunotherapy

Indications for immunotherapy include IgE-mediated allergy that is not readily controlled by simple pharmacotherapeutic measures, symptoms that are severe and/or prolonged, and are produced by allergens that are not readily avoidable. In addition, immunotherapy should in general only be considered in patients who are likely to cooperate in a program that will span 3 to 5 years.

The technique of immunotherapy involves the use of doses of antigen that are as high as safely possible to administer for each reacting allergen to reach therapeutic levels as quickly as possible. This is best accomplished by quantitation through in vitro means (RAST or ELISA) or intradermal dilution testing (skin endpoint titration). Progressively larger doses and more concentrated antigen solutions are used, while always watching carefully for unacceptable local reactions (a skin wheal of 3 cm or more) or worsening of systemic symptoms after an injection. Eventually, doses of about 40 to 1000 μg of antigen (corresponding to a 1:500 weight/volume concentration of extract) should be achieved to produce long-term beneficial results[45].

Injections are normally administered once or twice weekly until desired effects are noted, then once a week for a total of 1 year. Maintenance therapy is given every 2 to 3 weeks, and the total duration of

therapy generally does not exceed 3 to 5 years. Although systemic reactions rarely complicate immunotherapy, which is based on the quantitative testing methods described, they remain a possibility. Thus, immunotherapy should only be administered by qualified personnel and in a setting in which appropriate treatment of adverse reactions is possible [46,47].

CONCLUSION

Allergic rhinitis might present as a distinct clinical entity or might coexist with (and contribute to) other disease states such as sinusitis, polyposis, asthma, and laryngitis. The otorhinolaryngologist should be able to suspect the presence of nasal allergy on the basis of typical history and physical examination, administer appropriate pharmacotherapy, and advise patients in proper environmental control. Testing to confirm specific inciting antigens and the administration of definitive immunotherapy might require referral but should not be outside the abilities of the properly trained otolaryngologist.

MATERIALS AND METHODS

STUDY DESIGN

A prospective study with consecutive sampling of all allergic rhinitis patients with symptomatic deviated nasal septum undergoing conventional septoplasty during the study period

SUBJECTS

The study was conducted in a tertiary referral center – Department of otorhinolaryngology, Government Rajaji Hospital, Madurai. All patients of allergic rhinitis with symptomatic deviated nasal septum who underwent septoplasty during the study period. Patients with Deviated nasal septum(DNS) were chosen based on their complaint about difficulty in nasal breathing and diagnosis made based solely on anterior rhinoscopic findings. Diagnostic Nasal endoscopy (DNE) and CT PNS were done in all patients planned for septal surgery.

ANTERIOR RHINOSCOPY

Patients with DNS were chosen based on their complaint of difficulty in nasal breathing the diagnosis of DNS was made based on anterior rhinoscopic findings in the outpatient department.

Figure 14: ANTERIOR RHINOSCOPY

ALLERGIC RHINITIS

Clinical diagnosis of allergic rhinitis is based on standard criteria prescribed by Allergic Rhinitis and its Impact on Asthma(ARIA) 2007 guidelines[48,49]. Patient allergic rhinitis questionnaire was filled by the subjects and they were categorised into subgroups as intermittent or persistent and mild or moderate – severe based on ARIA guidelines

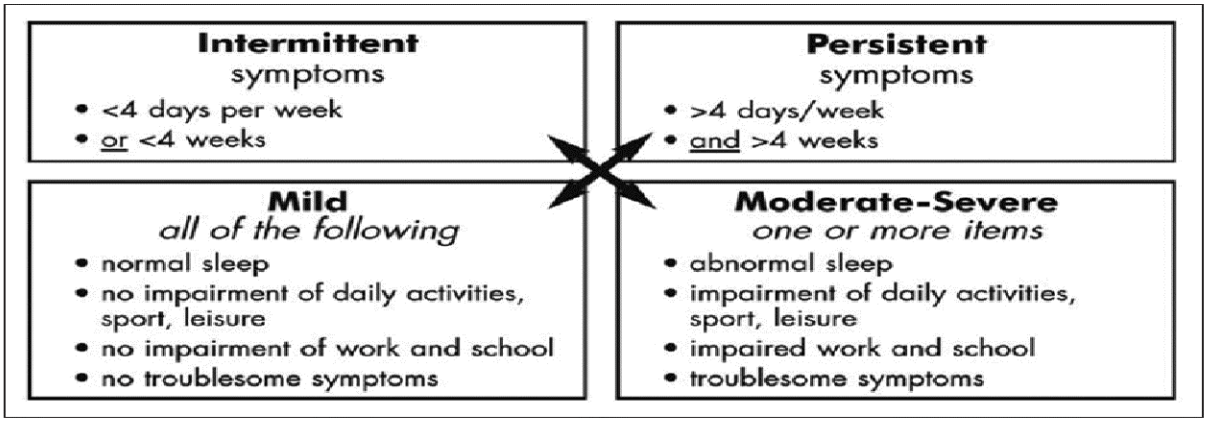
Standard criteria - Allergic Rhinitis And its Impact on Asthma (ARIA) guidelines 2007

SYMPTOMS SUGGESTIVE OF ALLERGIC RHINITIS

- Watery anterior Rhinorrhoea
- Sneezing, paroxysmal
- Nasal obstruction
- Nasal itching
- ± conjunctivitis

Presence of watery anterior rhinorrhoea± one or more of the other symptoms >1hour on most days

CLASSIFICATION



DIAGNOSTIC NASAL ENDOSCOPY

Diagnostic Nasal Endoscopy(DNE) was performed on all subjects using 4mm zero degree Hopkins rod endoscope for a more detailed description and evaluation of the nasal anatomy[50].

Side of maximum deviation, site of maximum deviation based on the five area division by Cottle[51], status of nasal mucousa(normal, pale or congested), turbinates(normal/hypertrophied) are studied

Coexistent pathologies such as sinusitis and polyps are ruled out

Figure 15: Zero degree Hopkins rod nasal endoscope

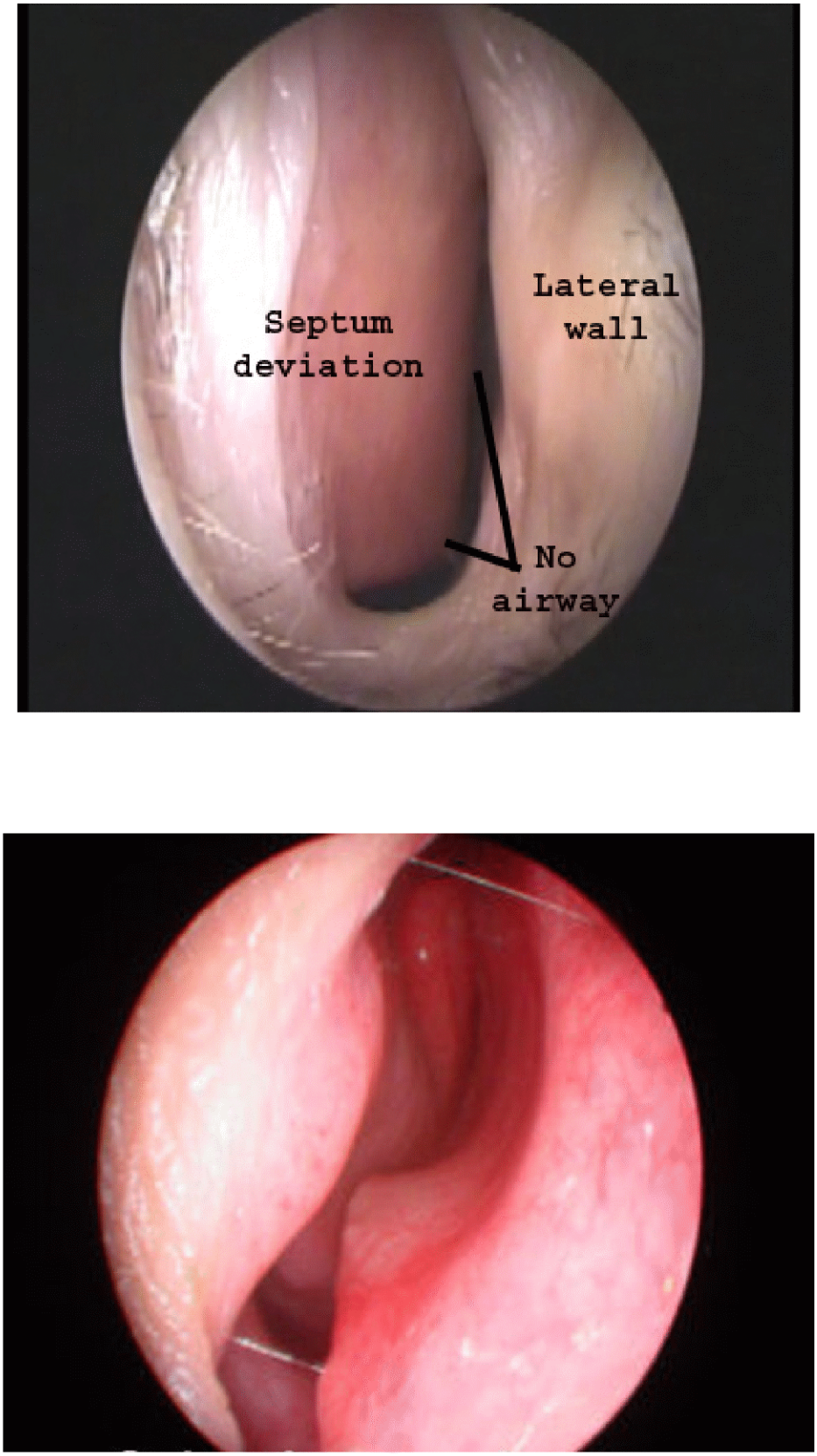


Figure 16: Nasal endoscopy showing septal deviation and spur

COTTLE'S AREA (figure 17)

1. Vestibular area

2. Valvular area

3. Attical area

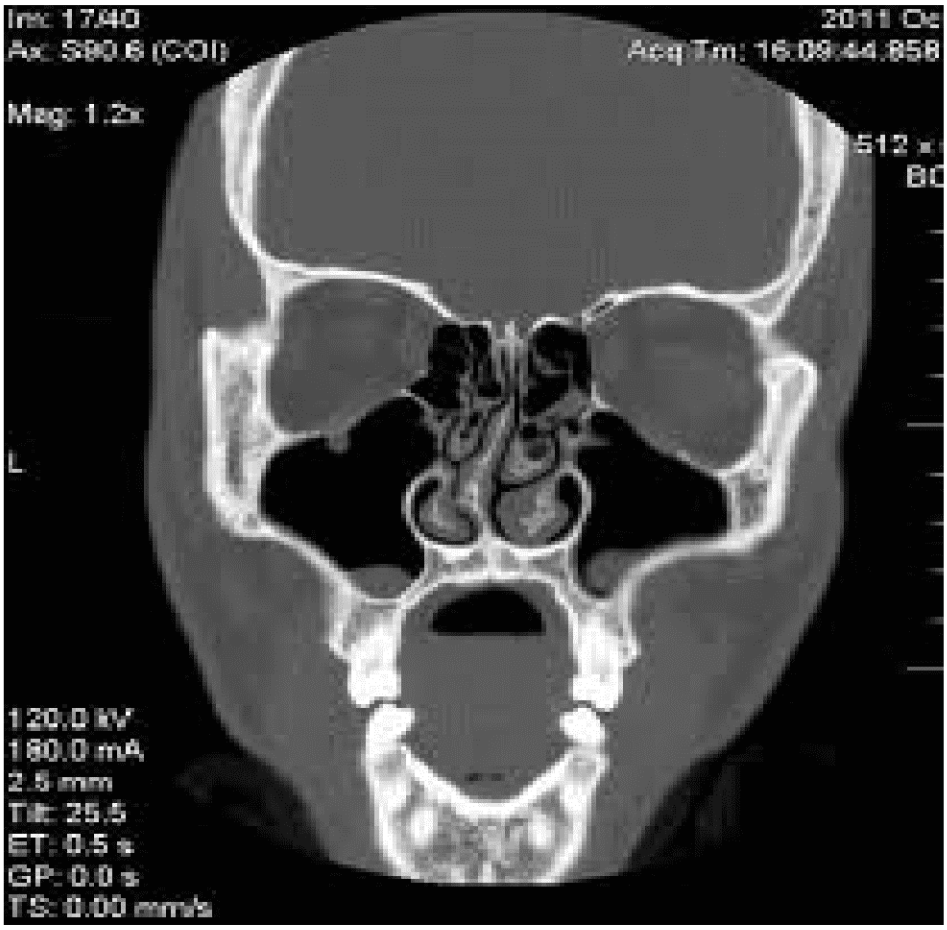
4. Medial turbinal area

5. Posterior turbinal/ Choanal area

Figure 17: COTTLE'S AREA

CT PNS

This is done to study the status of paranasal sinuses and to rule out associated sinusitis and polypi. Septal deformities were classified using Mladina classification modified by Janardhan et al.[52,53,54,55] which classifies septal deformities into seven types. In this classification Type I–VI are separate entities while Type VII is combination of Type I–VI



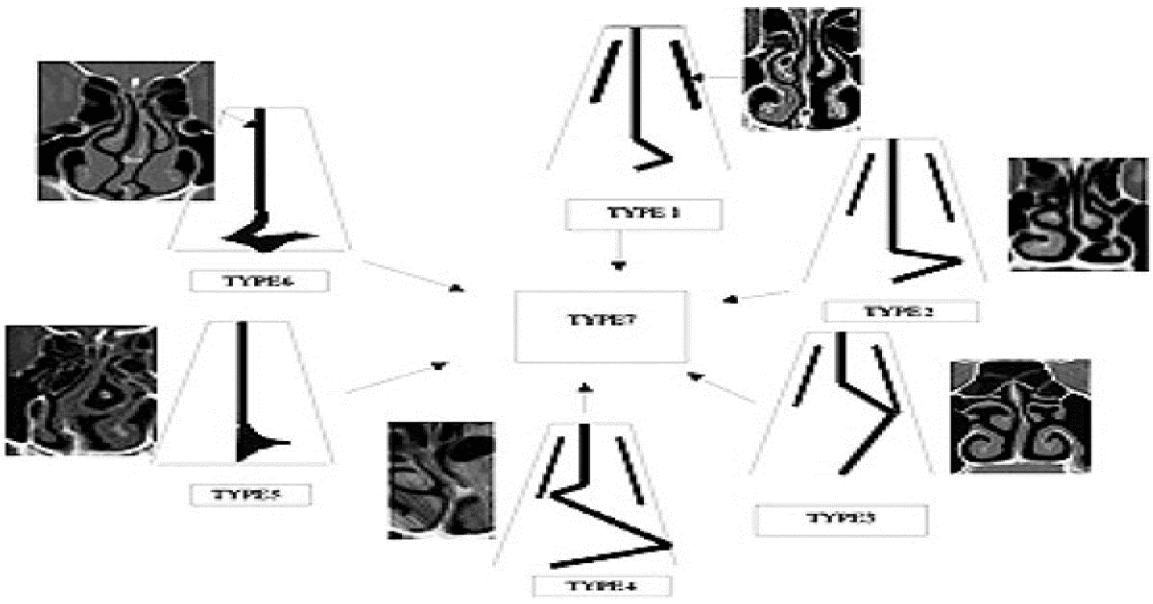


Figure 18: CT PNS and Mladina classification of septal deviations

ABSOLUTE EOSINOPHIL COUNT

Absolute Eosinophil Count is measured in all subjects included in the study using standard venous blood. AEC≥440/mm^3 is considered significant[57,58].

SELF ASSESSMENT NOSE SCALE

All participants were assessed the severity of their symptoms based on a Nasal Obstruction Symptom Evaluation (NOSE) Scale prior to and a month following septoplasty[5,54,55,56]. Patients were divided into subgroups according to ARIA guidelines of allergic status, comparisions were made.

ID# _____ Date _____

Nasal Obstructive Symptoms Evaluation Scale

→ To the Patient: Please help us to better understand the impact of nasal obstruction on your quality of life by completing the following survey. Thank you!

Over the past 1 month, how much of a problem were the following conditions for you?
Please Circle the Most Correct Response

	Not a Problem	Very Mild Problem	Moderate Problem	Fairly Bad Problem	Severe Problem
1. Nasal congestion or stuffiness	0	1	2	3	4
2. Nasal blockage or obstruction	0	1	2	3	4
3. Trouble breathing through my nose	0	1	2	3	4
4. Trouble sleeping	0	1	2	3	4
5. Unable to get enough air through my nose during exercise or exertion	0	1	2	3	4

6. Please mark on this line how troublesome is your difficulty in breathing through your nose:

None — Medium — Severe

Figure 19: NOSE Scale

ALLERGIC RHINITIS CONTROL TEST (ARCT) QUESTIONNAIRE

A five item Allergic Rhinitis Control Test (ARCT) questionnaire[7] was given to allergic patients according to ARIA 2007 guidelines[50,51] who underwent septoplasty prior to surgery and at the end of two months following surgery. Improvement in the allergic status following surgery was evaluated.

Allergic rhinitis control test

During the last 2 weeks, has your allergic rhinitis had an effect on your professional/personal activities?					
Permanently	Very often	Often	Not often	Never	Points
1	2	3	4	5	
During the last 2 weeks, has your allergic rhinitis made you irritable?					
Permanently	Very often	Often	Not often	Never	Points
1	2	3	4	5	
During the last 2 weeks, has your allergic rhinitis disturbed your sleep (going to sleep, waking at night)?					
Permanently	Very often	Often	Not often	Never	Points
1	2	3	4	5	
During the last 2 weeks, have you needed to use an additional treatment not prescribed by your doctor to treat your allergic rhinitis?					
Four nights or more per week	Two to three nights per week	One night per week	One to two times in all	Never	Points
1	2	3	4	5	
During the last 2 weeks, how would you assess your allergic rhinitis?					
Not controlled at all	Very slightly controlled	Somewhat controlled	Well controlled	Completely controlled	Points
1	2	3	4	5	
Total score					

Figure 20: ARCT Questionnaire

INCLUSION CRITERIA

1. Allergic rhinitis patients with symptomatic deviated nasal septum who underwent conventional septoplasty who were willing to take part in the study regardless of age, sex, duration and severity of nasal symptoms

2. Patients who underwent concomitant inferior turbinate volume reduction

3. Patients were included regardless of recent local medication use such as steroid nasal spray, oral antihistaminics for control of nasal allergy

4. Patients were classified into mild or moderate- severe and intermittent or persistent allergic rhinitis according to ARIA 2007

EXCLUSION CRITERIA

1. Patients who underwent other forms of septal correction such as SMR

2. Patients who underwent endoscope assisted septal corrections

3. Patients with co-existent sinus pathologies such as sinusitis or polyp or those who underwent septoplasty in addition to any form of endoscopic sinus surgery, antrostomy, Caldwell luc, conchoplasty, rhinoplasty, etc.

4. Patients who underwent septoplasty as a part of another surgical procedure

5. Allergic patients receiving systemic steroids

6. Revision cases were excluded

SEPTOPLASTY – PROCEDURE

Anaesthesia

Endotracheal General anaesthesia

Local infiltration of the nasal septum, turbinates with 6 – 8ml of 2% lignocaine with 1:200000 adrenaline

Twenty minutes prior to surgery the nasal cavity is lightly packed with cotton wool soaked in topical 4 % lignocaine and adrenaline.

Preparation

The packs are removed from the nose and the vibrissae are trimmed with scissors. The surgeon cleans the whole face with Betadine solution, and the drapes are applied . It is important to check that the endotracheal tube is in the midline so that the tip of the nose is not distorted.

The operation

The incision

1. A hemitransfixation incision (figure 21) is performed with a no.15 blade at the caudal margin of the septal cartilage from the side of caudal dislocation.

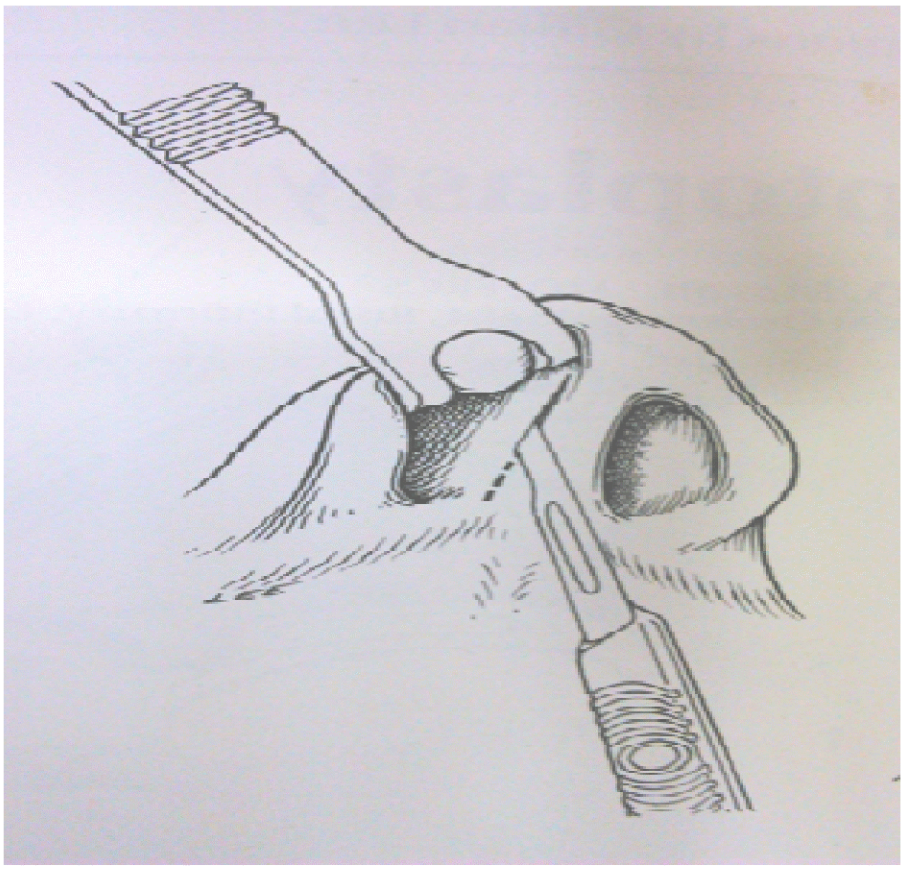


Figure 21: HEMITRANSFIXATION INCISION

Creation of Mucoperichondrial flaps (figure 22)

2. A freer elevator (figure 23), suction dissector is inserted and a plane developed back to the bony septum in the upper half of the septum.

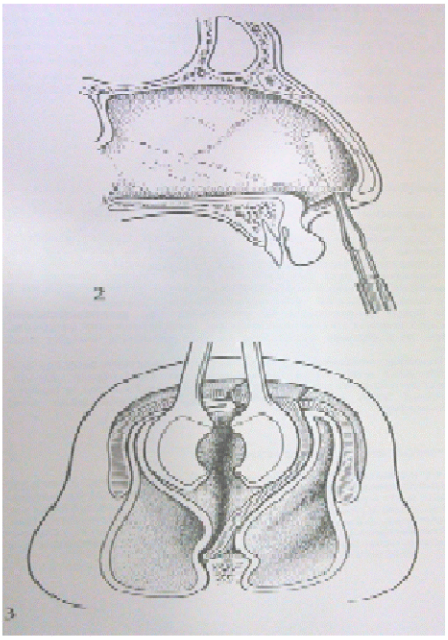


Figure 22: CREATION OF MUCOPERICHONDRIAL FLAPS

Figure 23: FREER ELEVATOR

3. A long Killian's speculum (figure 24) is inserted and opened. This distracts the cartilage from the mucoperichondrial flap and makes the dissection easy in the lower half (figure 25). A similar procedure is followed on the other side. A small strip of cartilage is resected at the caudal end to enable closure of the incision.

Figure 24: KILLIAN'S SPECULUM

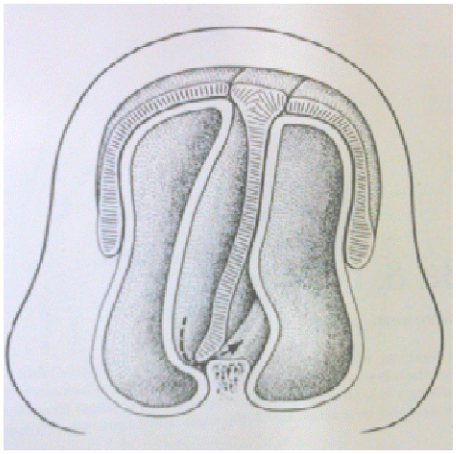


Figure 25: DISSECTION OF INFERIOR PART OF THE CARTILAGE

Dissection of the septum

4. Bony- cartilaginous junction is identified, cartilage is separated from bony attachment. Limited resection of the deviated part of the septal cartilage on either side is done (figure 26). The cartilaginous 'spur' which is equivalent to the inferior fractured edge of the septum, is identified and resected.

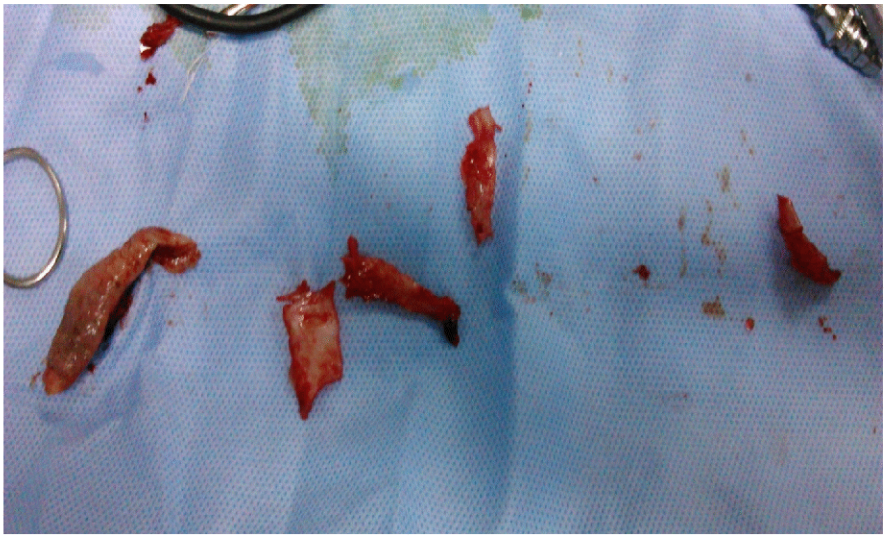


Figure 26: RESECTED PART OF SEPTAL CARTILAGE

Repositioning of the cartilage

5, 6 and 7. If there are any large bony deviations, these are removed using Luc's forceps (figure 27), bony spur resected using mallet and gouge (figure 28). Maxillary crest lowered using Killian's gouge. 0.5 to 1cm of Vomer and Ethmoid is removed to allow the cartilage to be repositioned without catching on the bony margin. (figure 29)

Figure 27: LUC'S FORCEPS

Figure 28: MALLET AND GOUGE

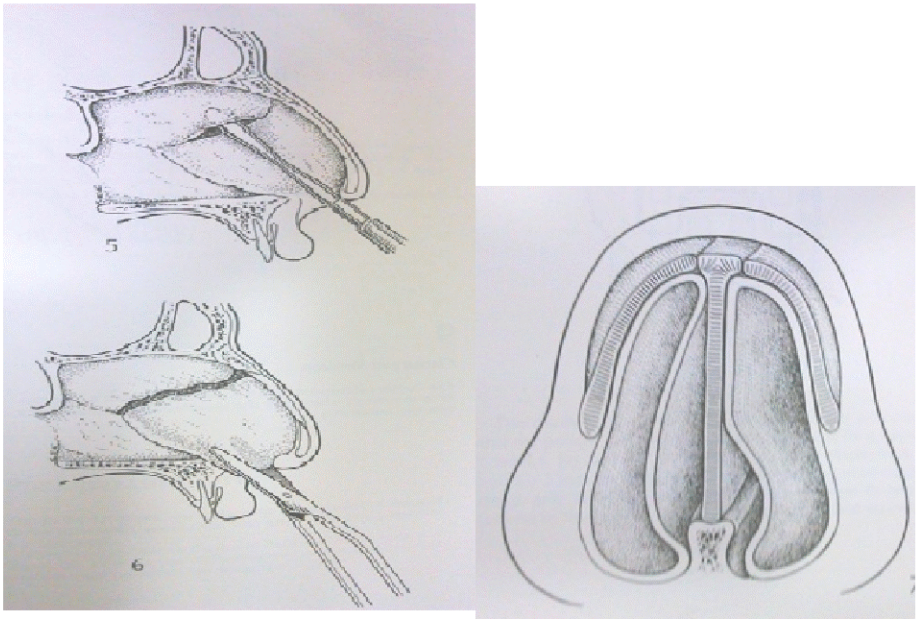


Figure 29: REPOSITIONING OF THE CARTILAGE

8. Closure of incision

Hemitransfixation incision is closed by 4-0 Vicryl sutures(figure30).

9. Stabilising the septum

Anterior nasal packing with Soframycin coated tape gauze is done.

Figure30: Vicryl suture

Post- operative care

1. Antibiotics and analgesics for 7 days.

2. Nasal pack removal on 1st POD.

4. Oxymetazoline nasal drops for 1 week following pack removal.

5. Frequent nasal saline douches.

6. Endoscope assisted nasal cleaning every week for four consecutive weeks.

STATISTICAL ANALYSIS

Univariate comparisons of patient characteristics were made pre and post operatively among allergic rhinitis patients undergoing septoplasty. Continuous variables were compared using the independent samples t-test and other tests as appropriate. Methods appropriate for paired data were applied to assess the degree of change in NOSE scores after Septoplasty. Similarly the improvement in ARCT score following septoplasty in allergic rhinitis patients with deviated nasal septum was studied.

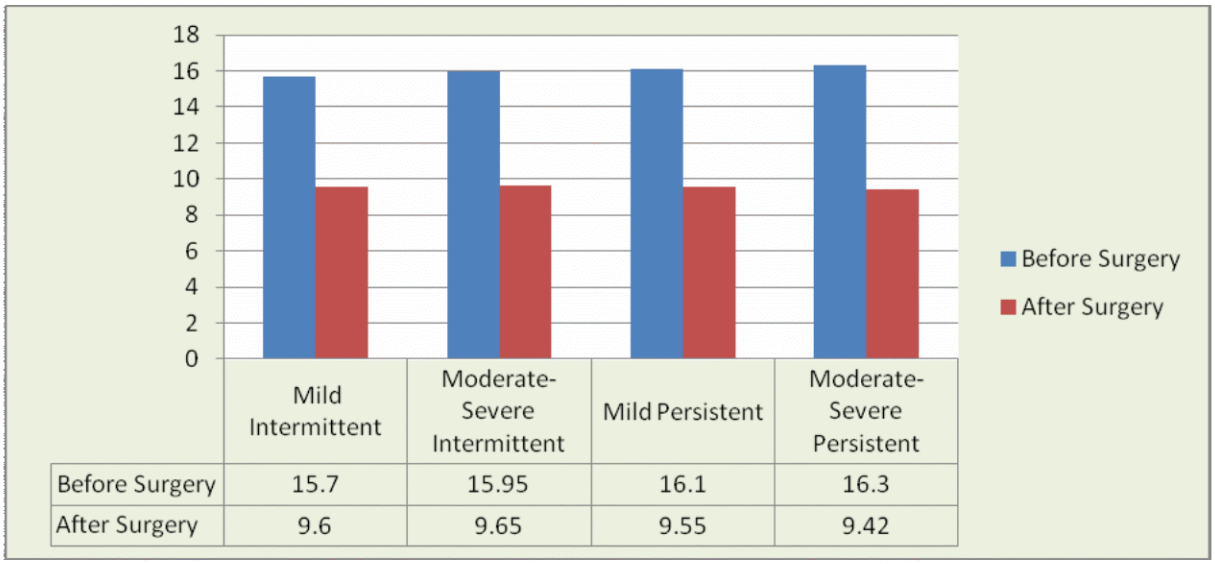
COMPARISION OF DECREASE IN NOSE SCORE FOLLOWING SEPTOPLASTY

Table 1: Comparision of NOSE score before and after septoplasty

NOSE score	Mean Before	Mean After	N	sd before	sd after	p value
Mild Intermittent	15.7	9.6	10	1.252	0.699	<0.001**
Moderate- Severe intermittent	15.95	9.65	40	1.839	0.662	<0.001**
Mild persistent	16.1	9.55	38	1.189	0.645	<0.001**
Moderate- Severe persistent	16.3	9.42	12	0.965	0.900	<0.001**
Mean	16.03	9.58	100			<0.001**

**Denotes significant at 1% level

Chart 1: Comparision of NOSE score before and after septoplasty

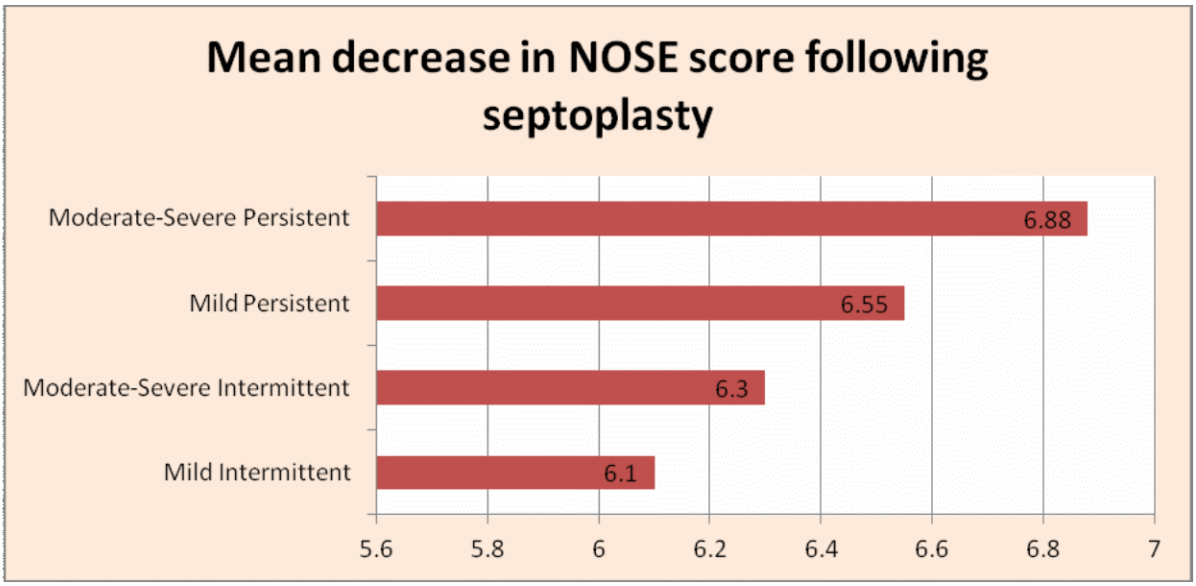


The decrease in NOSE score following septoplasty in each of the four groups is found to be statistically significant (p<0.001)

Table 2: Comparision of mean decline in NOSE score

Allergic Groups	**Mean decrease in NOSE score following septoplasty**
Mild Intermittent	6.1
Moderate-Severe Intermittent	6.3
Mild Persistent	6.55
Moderate-Severe Persistent	6.88

Chart 2: Comparision of mean decline in NOSE score



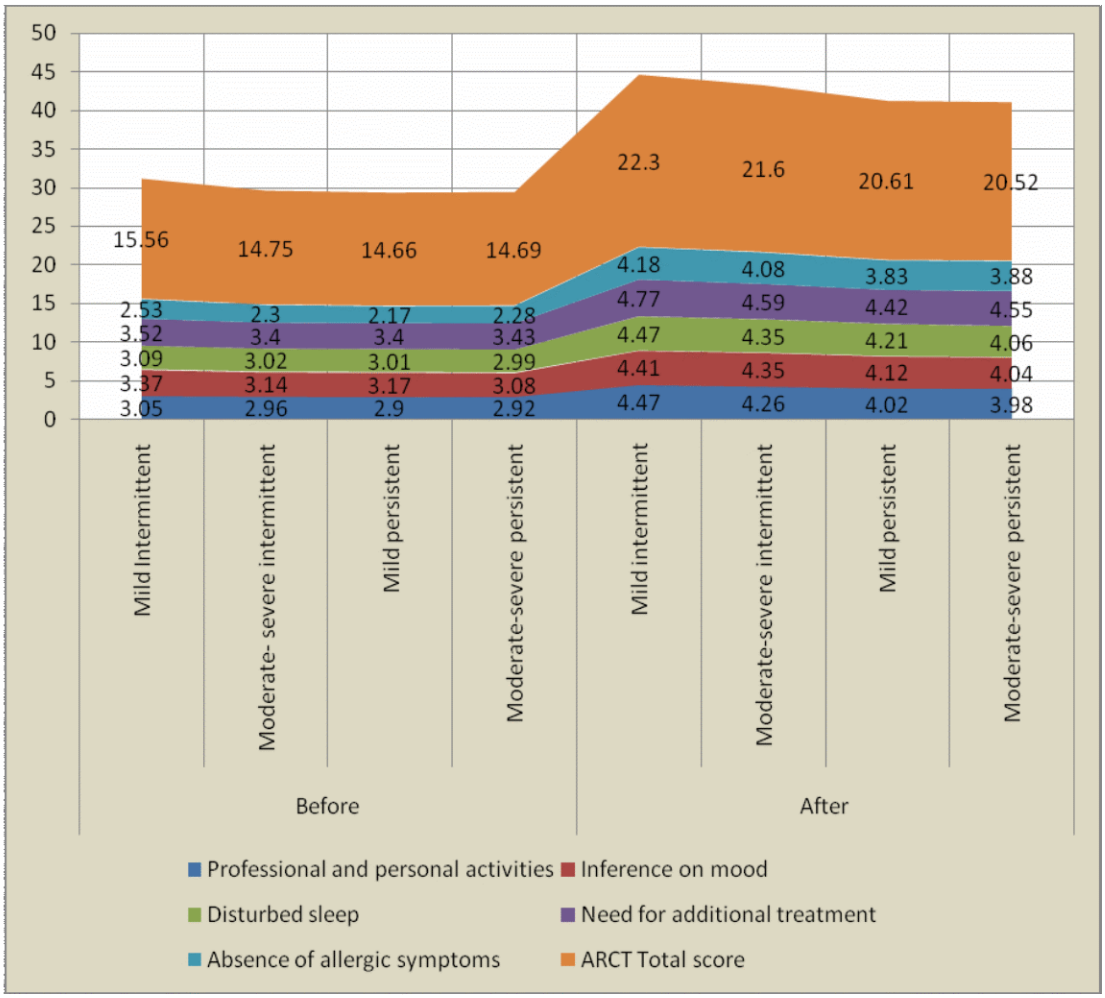
The mean decrease in NOSE score is more than 6 in all the four groups

Table 3: ARCT score before and after septoplasty

ARCT score	Mild Intermittent(10)				Moderate-severe intermittent (40)				Mild Persistent (38)				Moderate-severe persistent (12)				
	Before		After		Before		After		Before		After		Before		After		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p value
Professional and personal activities	2.8	0.422	4.4	0.516	2.564	0.502	4.128	0.339	2.526	0.506	4.053	0.226	2.417	0.515	4.083	0.289	$< 0.001^*$
Inference on mood	2.9	0.568	4.6	0.516	2.872	0.409	4.308	0.468	2.789	0.413	4	0	2.917	0.289	4	0	$< 0.001^*$
Disturbed sleep	2.9	0.316	4.5	0.527	2.641	0.486	4.359	0.486	2.579	0.5	4.158	0.37	2.583	0.515	4.083	0.289	$< 0.001^*$
Need for additional treatment	2.7	0.675	4.8	0.422	2.769	0.485	4.667	0.478	2.763	0.49	4.5	0.507	2.917	0.289	4.667	0.492	$< 0.001^*$
Absence of allergic symptoms	2.2	0.422	4	0	1.974	0.362	4.026	0.16	1.895	0.311	3.947	0.226	1.917	0.289	3.917	0.289	$< 0.001^*$
Total score	13.5	1.08	22.3	0.823	12.821	0.885	21.487	0.854	12.553	1.108	20.658	0.534	12.75	0.965	20.75	0.754	$< 0.001^*$
				$<0.001^*$				$<0.001^*$				$<0.001^*$				$<0.001^*$	

* Denotes significant at 1% level

Chart 3: ARCT score before and after septoplasty

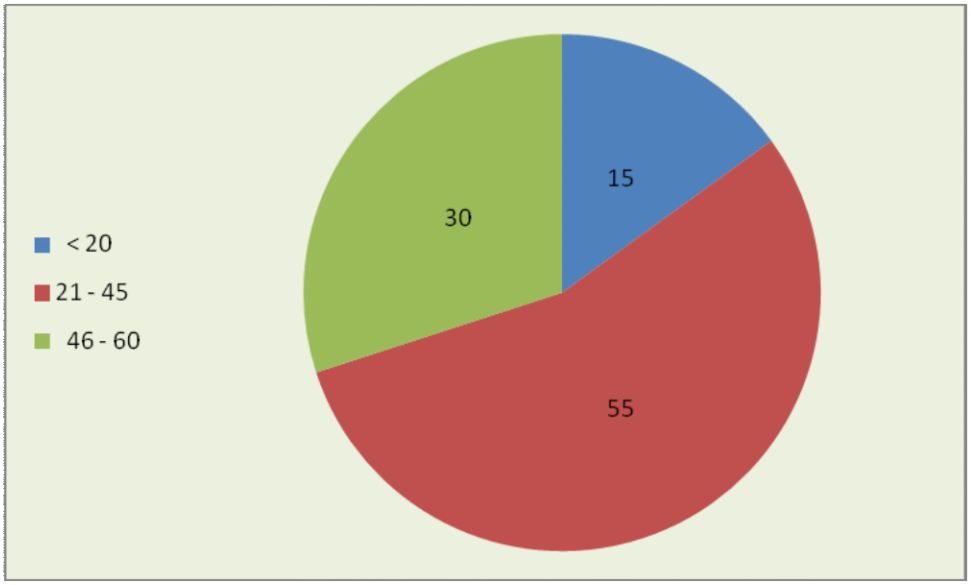


The ARCT score two months following septoplasty has increased to a stastistically significant in each of the four allergic groups showing remarkable control of allergic rhinitis following the procedure

Table 4: Age distribution

Age in years	No.of cases
≤ 20	15
21 - 45	55
46 - 60	30
Total	100

Chart 4: Age distribution

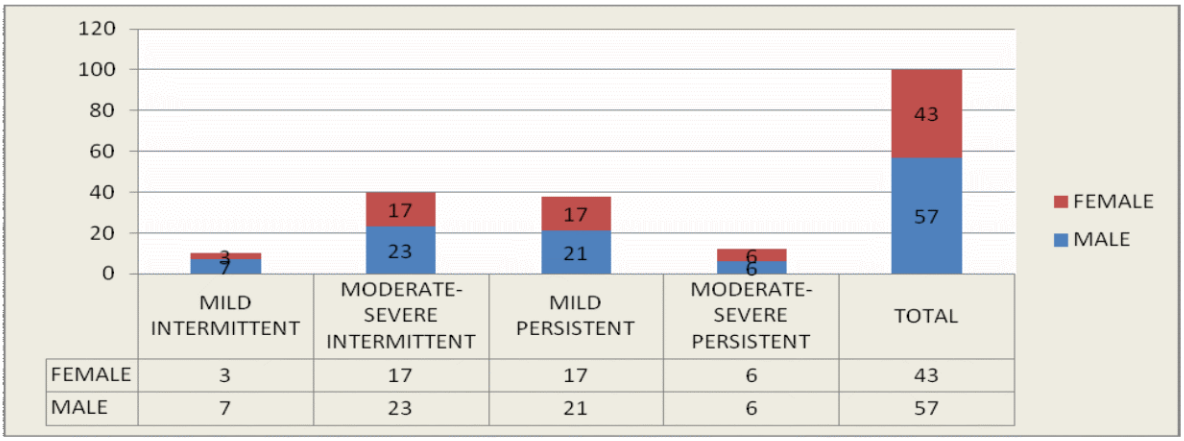


The study population had maximum number of patients between 21 to 45 years

Table 5 :Sex distribution

Sex	No.of cases
Male	57
Female	43
Total	100

Chart 5: Allergic groups and Sex distribution



	MILD INTERMITTENT	MODERATE-SEVERE INTERMITTENT	MILD PERSISTENT	MODERATE-SEVERE PERSISTENT	TOTAL
FEMALE	3	17	17	6	43
MALE	7	23	21	6	57

The study population had 57 male and 43 female patients (n=100)

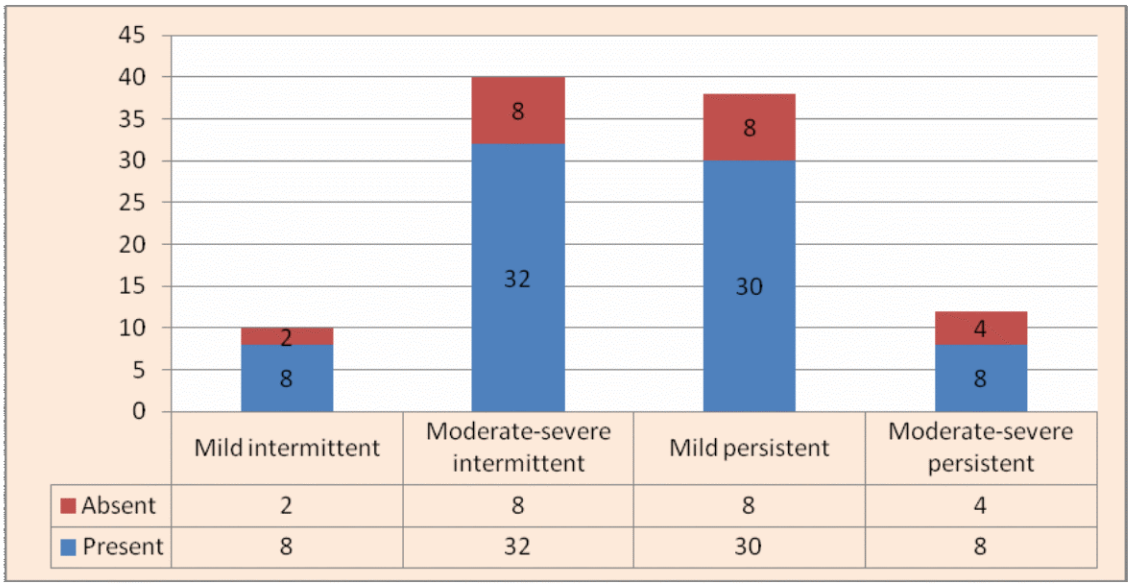
10 in the mild intermittent group

40 in the moderate-severe intermittent group

38 in the mild persistent group

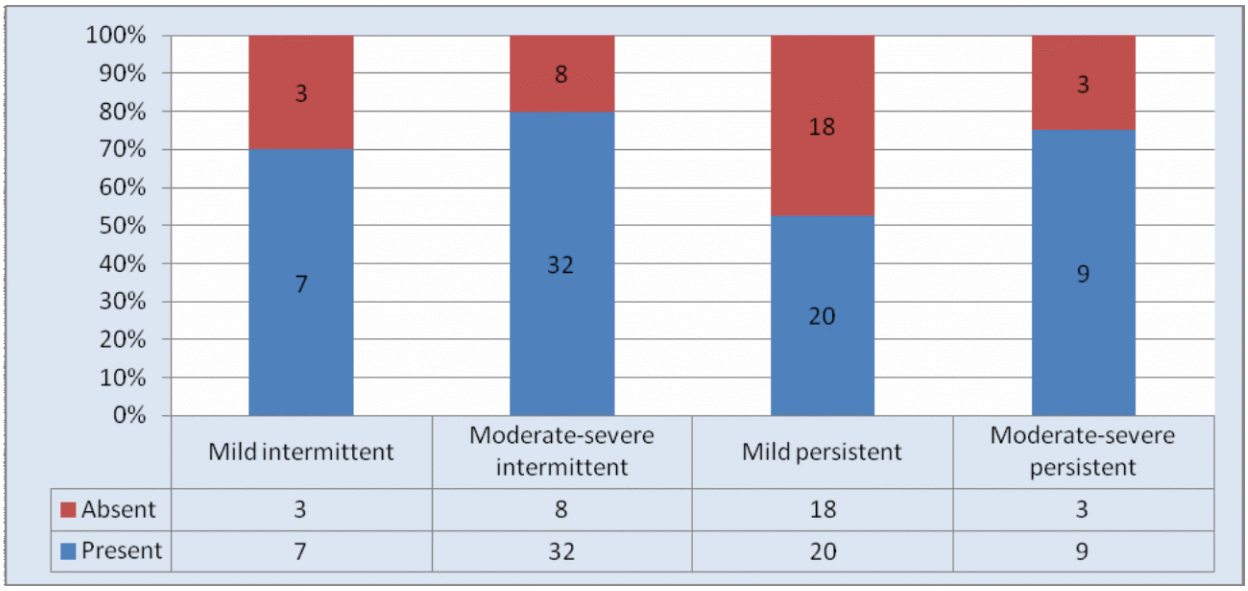
12 in the moderate-severe persistent group

Chart 6: Paroxysmal sneezing



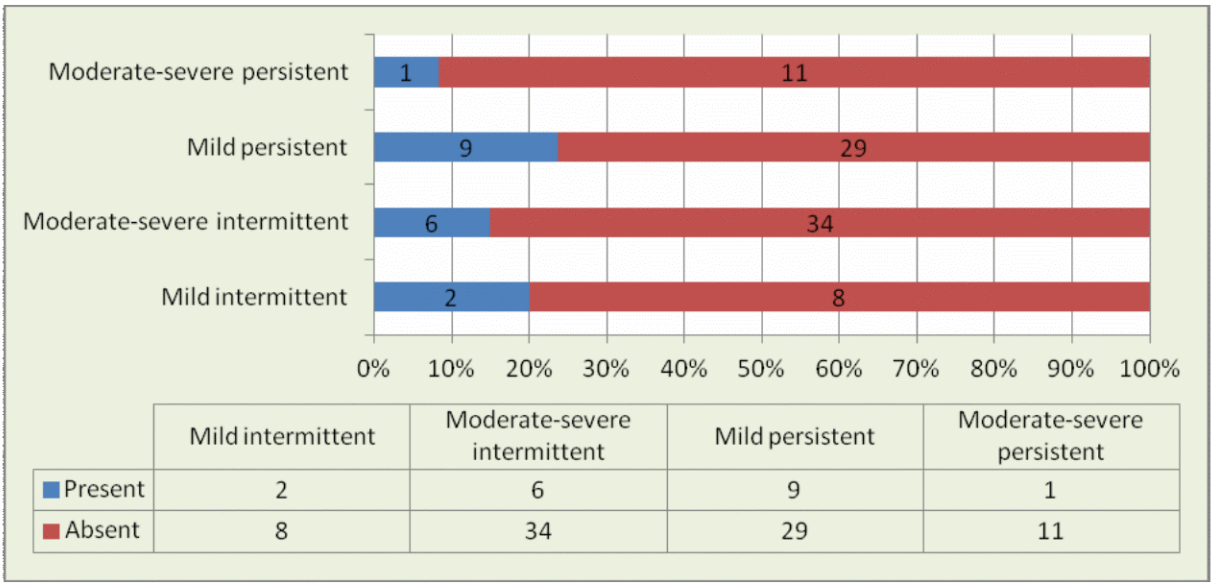
78 out of 100 patients reported paroxysmal sneezing

Chart 7: Nasal Itching



Symptoms of nasal itching was present in 68 patients (n=100)

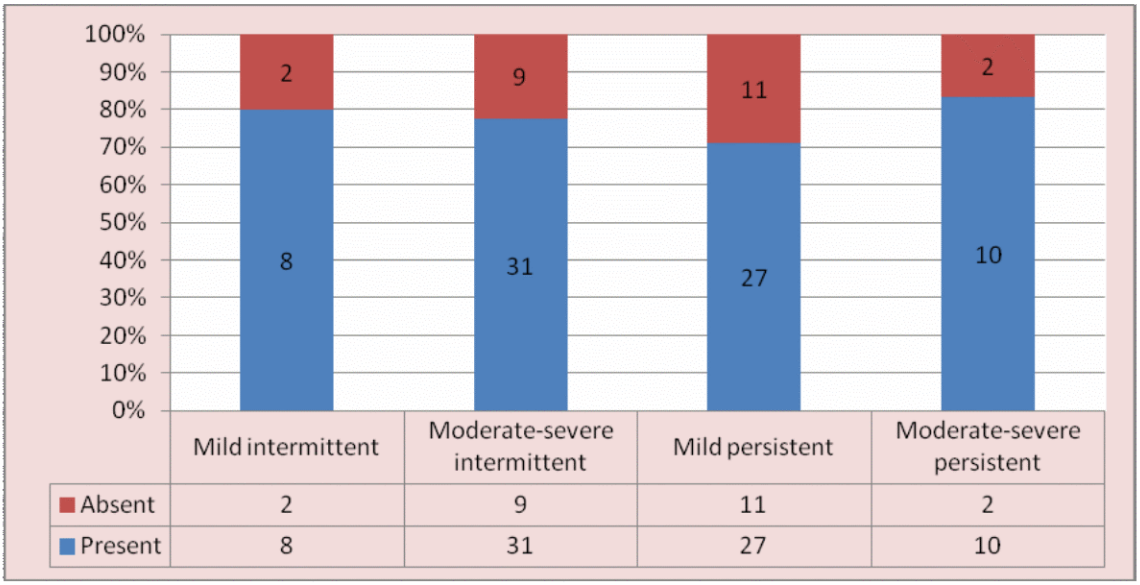
Chart 8: Red Itchy eyes



	Mild intermittent	Moderate-severe intermittent	Mild persistent	Moderate-severe persistent
Present	2	6	9	1
Absent	8	34	29	11

18 patients (n=100) had complaints of red itchy eyes

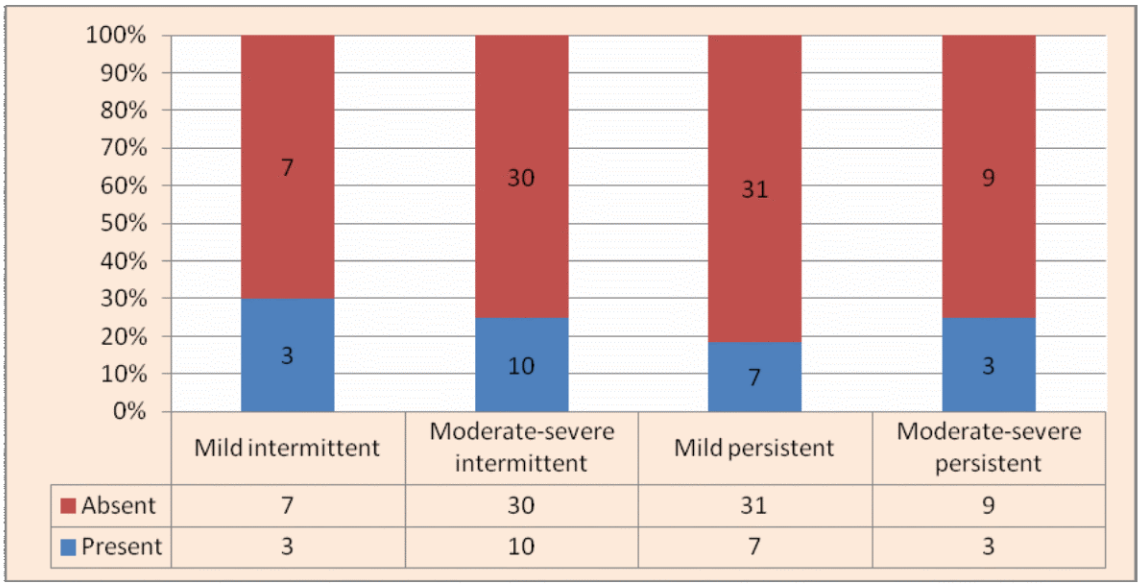
Chart 9:Headache



	Mild intermittent	Moderate-severe intermittent	Mild persistent	Moderate-severe persistent
Absent	2	9	11	2
Present	8	31	27	10

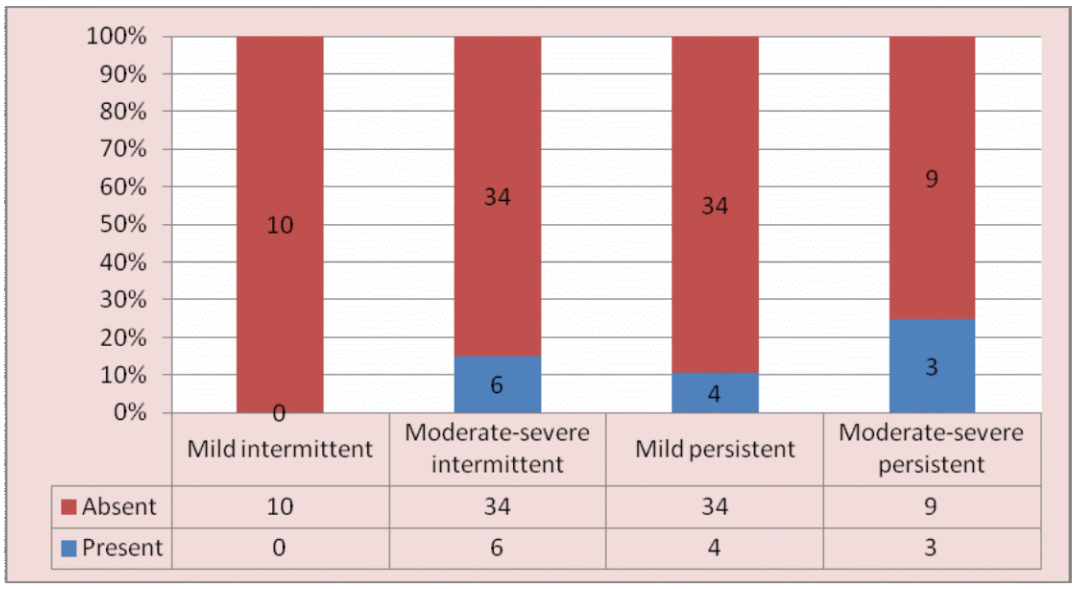
76 patients (n=100) had complaints of headache

Chart 10: Post nasal drip



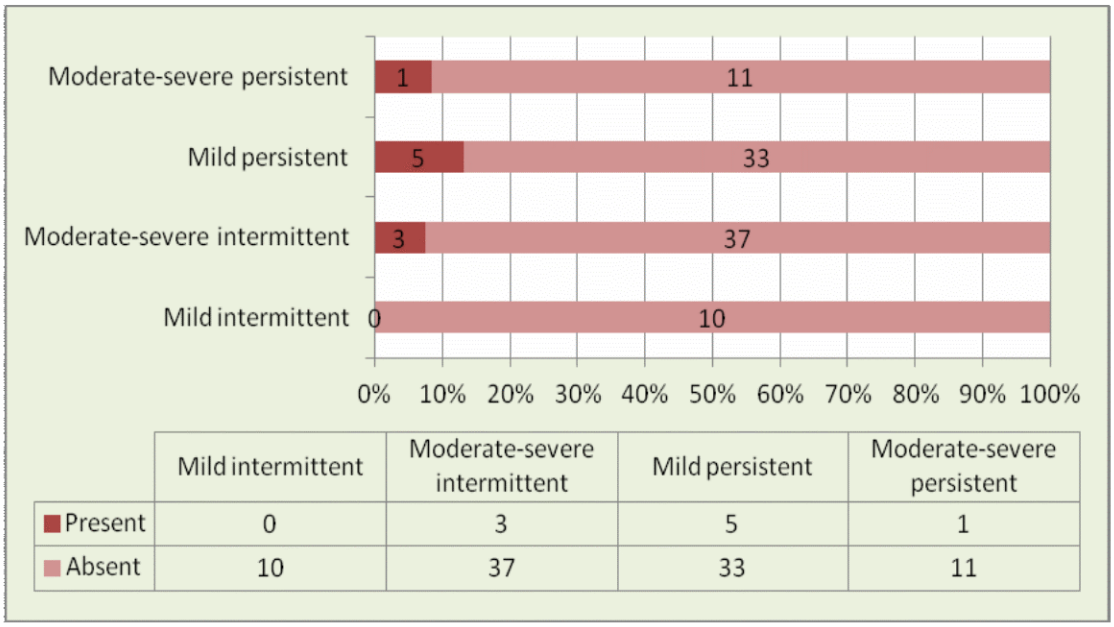
Post nasal drip was present in 23 patients (n=100) in our study

Chart 11: Nasal bleed



13 patients (n=100) complained of nasal bleed. None of the 10 patients in mild intermittent group had complaints of nasal bleed

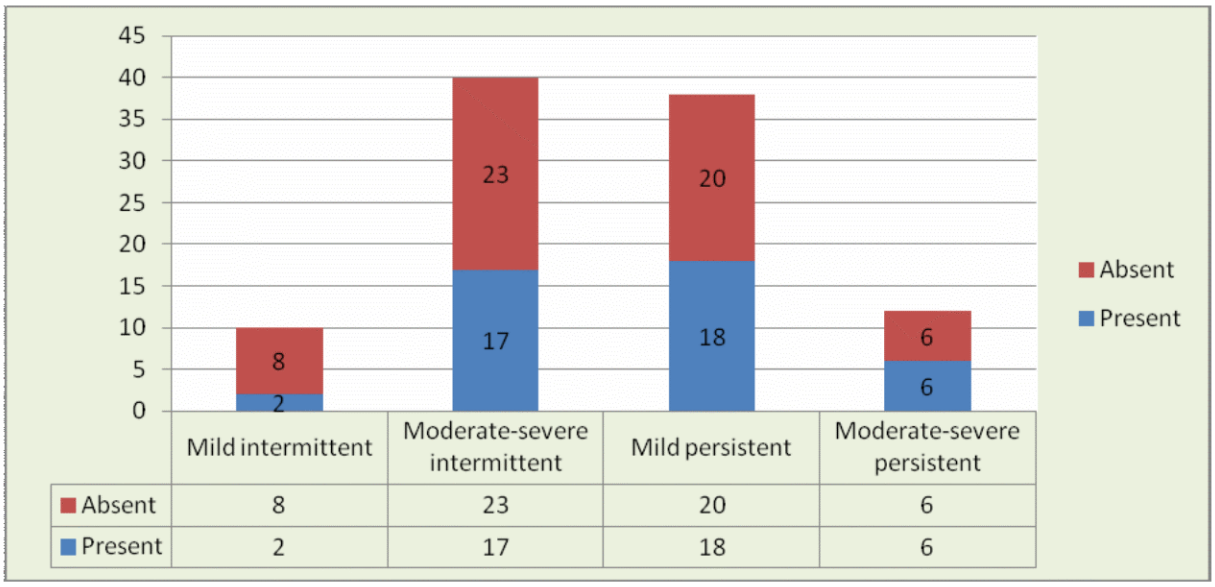
Chart 12: Smell disturbance



	Mild intermittent	Moderate-severe intermittent	Mild persistent	Moderate-severe persistent
Present	0	3	5	1
Absent	10	37	33	11

A total of 9 patients (n=100) had complaints of smell disturbance, none of the mild intermittent patients had smell disturbance complaints

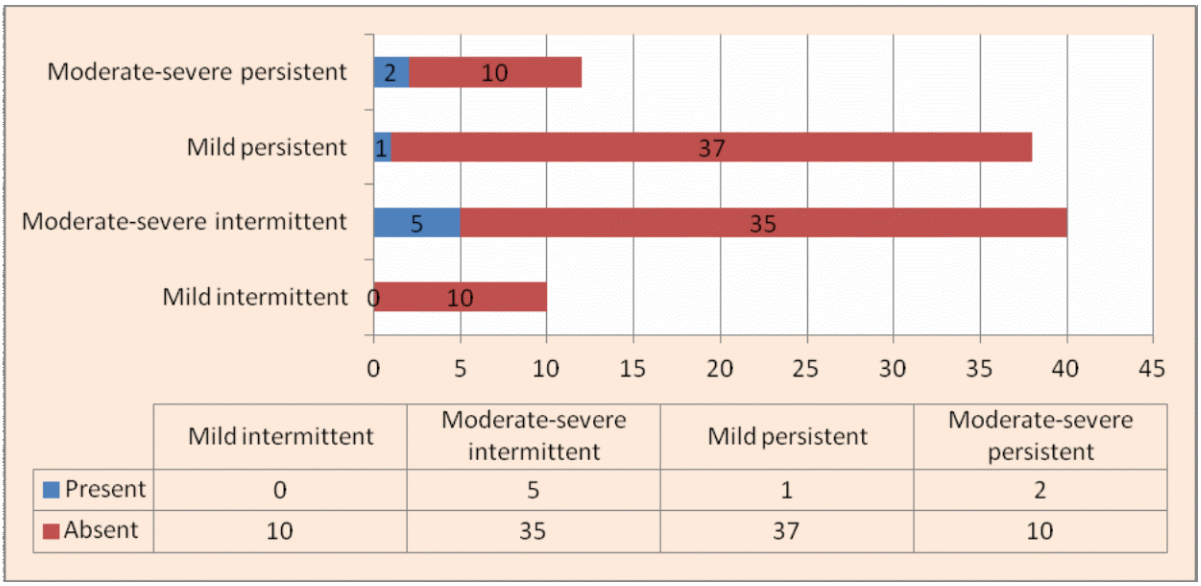
Chart 13: Snoring



	Mild intermittent	Moderate-severe intermittent	Mild persistent	Moderate-severe persistent
Absent	8	23	20	6
Present	2	17	18	6

Snoring was present in 43 (n=100) patients

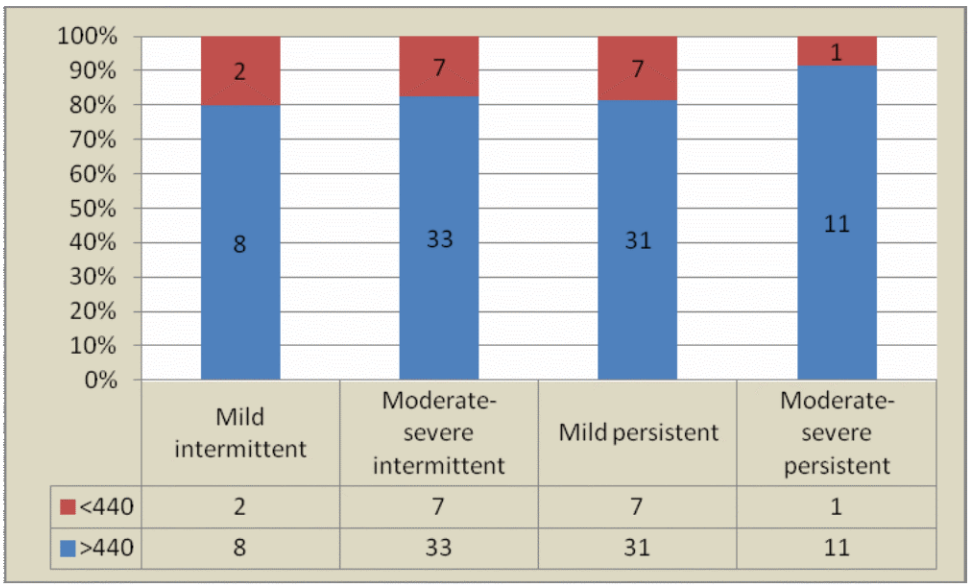
Chart 14: Facial pain



	Mild intermittent	Moderate-severe intermittent	Mild persistent	Moderate-severe persistent
Present	0	5	1	2
Absent	10	35	37	10

8 patients (n=100) complained of facial pain in our study

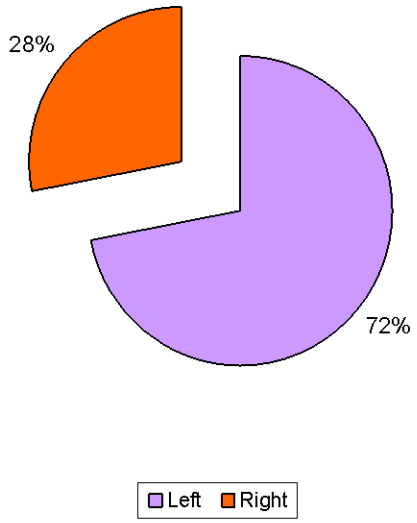
Chart 15: Absolute eosinophil count



	Mild intermittent	Moderate-severe intermittent	Mild persistent	Moderate-severe persistent
<440	2	7	7	1
>440	8	33	31	11

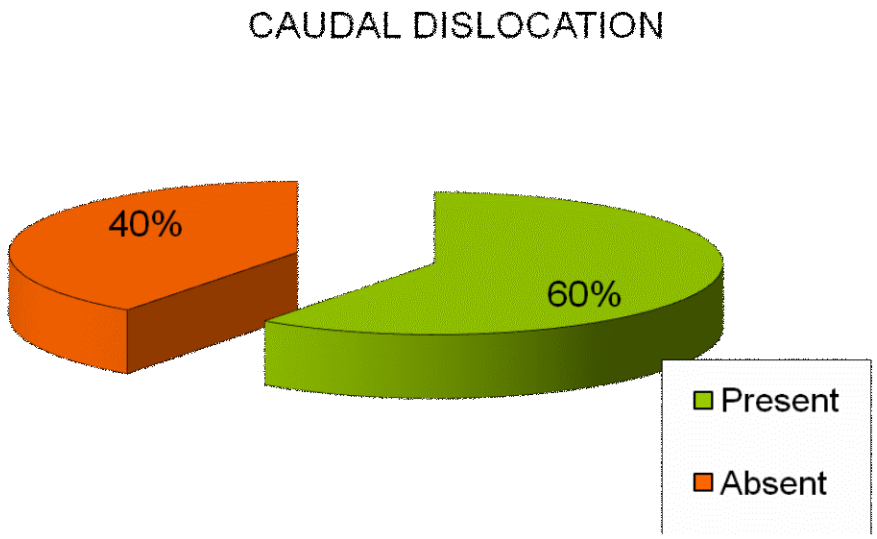
83 patients (n=100) had Absolute eosinophil count ≥ 440 cells per cu.mm.

Chart 16: Side of maximal deviation



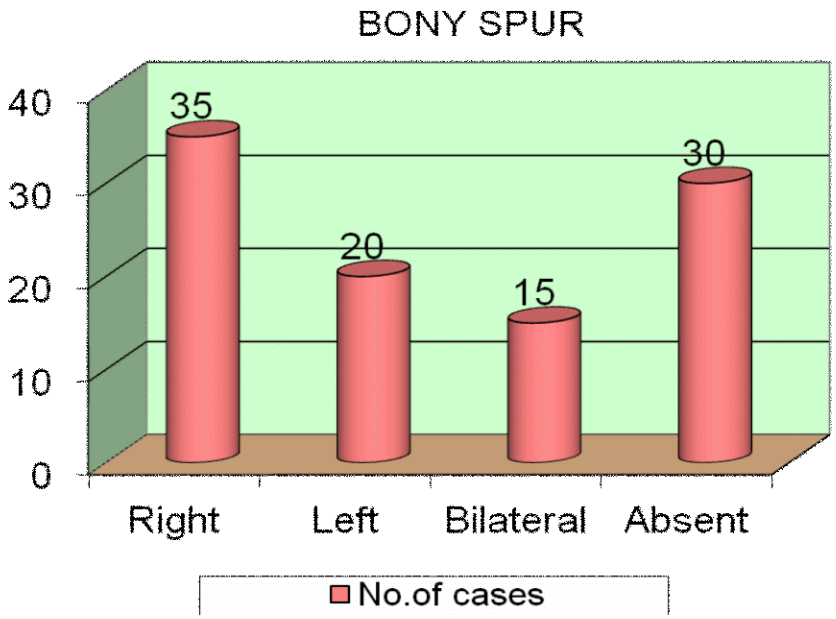
72 cases had deviated nasal septum to the left, 28 cases had DNS to the right(n=100)

Chart 17: Caudal dislocation



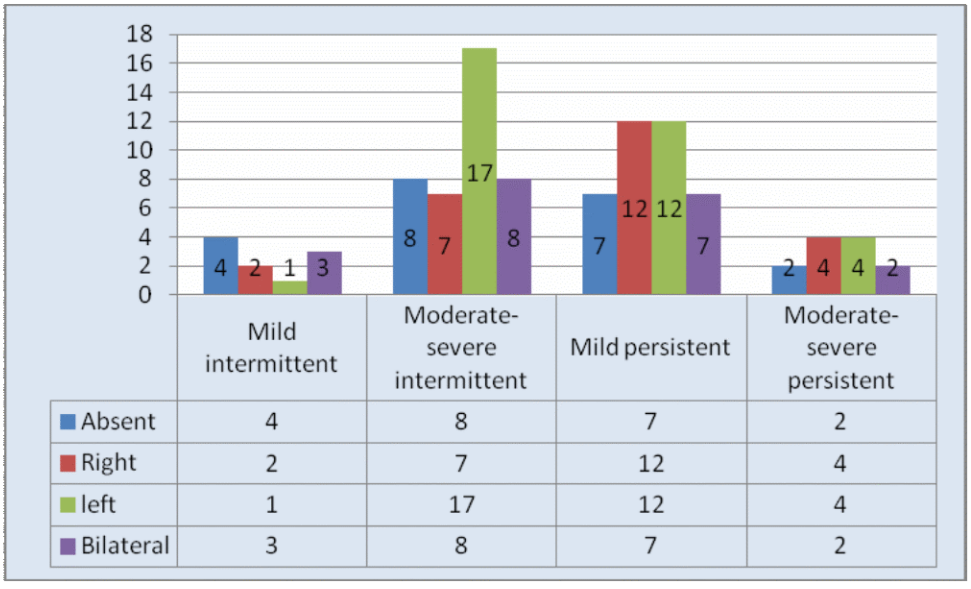
Caudal dislocation of the nasal septum was present in 60 cases(n=100)

Chart 18: Bony spur



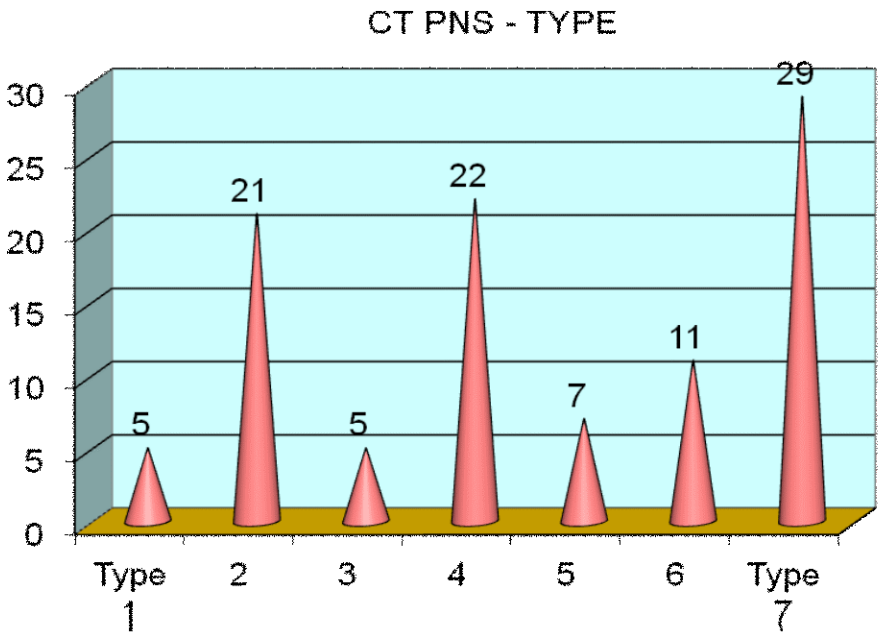
Among the 100 cases 35 patients had bony spur on the right side, 20 had left sided spur, bilateral spur in 15 cases

Chart 19: Turbinate hypertrophy



34 cases presented with left inferior turbinate hypertrophy, 25 cases had right inferior turbinate hypertrophy, 20 cases had bilateral inferior turbinate hypertrophy(n=100)

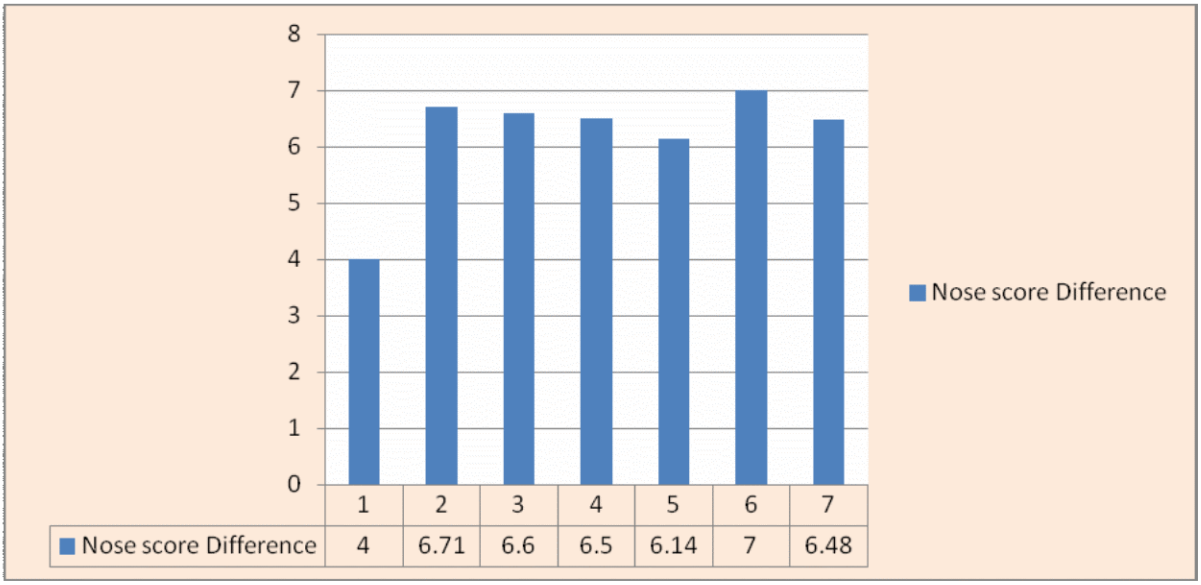
Chart 20: CT PNS type



CT PNS (Mladina's classification of septal deviations)		No. Of cases
TYPE 1	MILD DEVIATION IN VERTICAL PLANE	5
TYPE 2	MODERATE ANTERIOR VERTICAL DEVIATION	21
TYPE 3	POSTERIOR VERTICAL DEVIATION	5
TYPE 4	S -SHAPED, POSTERIOR TO ONE SIDE , ANTERIOR TO OTHER	22
TYPE 5	HORIZONTAL SEPTAL CREST TOUCHING OR NOT TOUCHING THE LATERAL WALL	7
TYPE 6	PROMINENT MAXILLARY CREST CONTRALATERAL TO THE DEVIATION WITH A SEPTAL CREST ON THE DEVIATED SIDE	11
TYPE 7	COMBINATION OF PREVIOUSLY DESCRIBED SEPTAL DEFORMITY TYPES	29

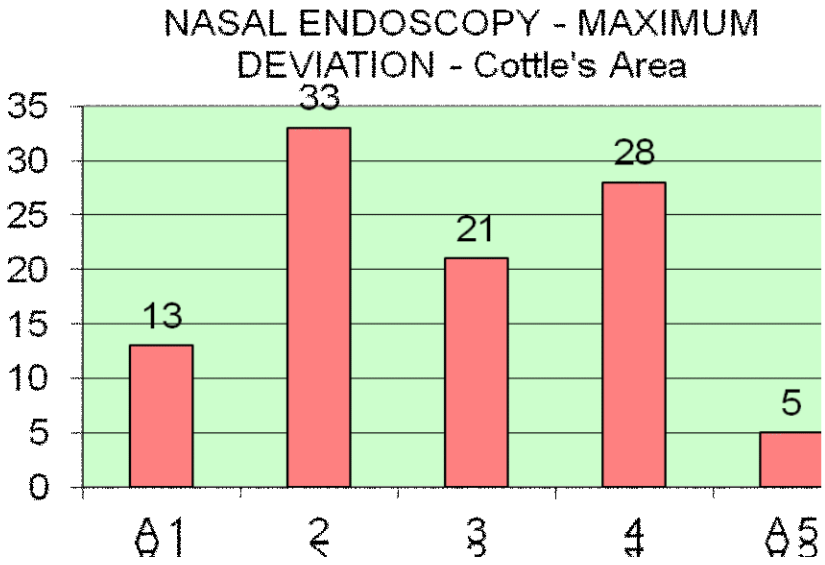
Chart 21: MEAN DECREASE IN NOSE SCORE

ACCORDING TO CT PNS TYPE



The mean decrease in NOSE score following septoplasty was between 4 to7, with Mladina type 6 septal deformities showing maximum decrease and type 1 showing mimimum decrease

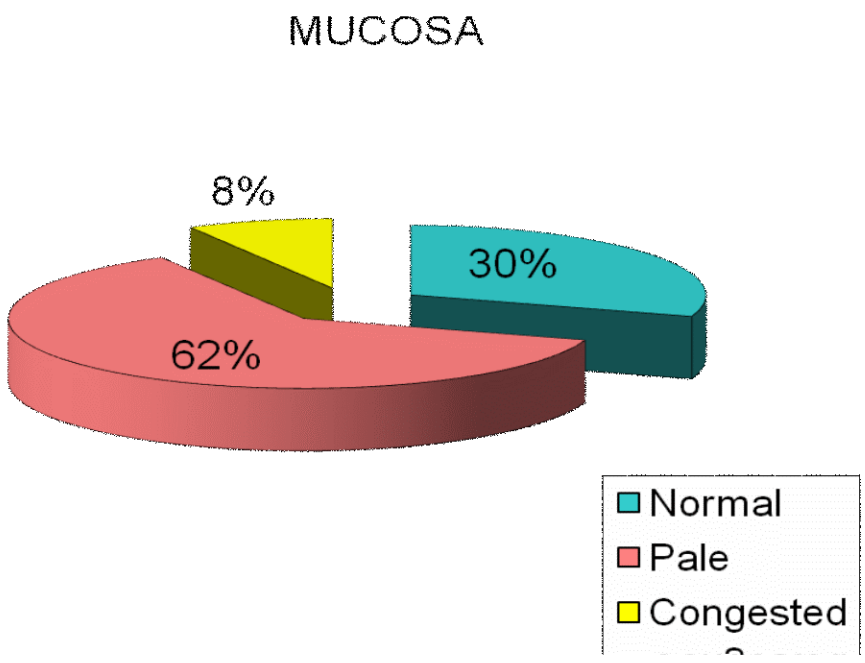
Chart 22: Septal deviation according to Cottle's area



SITE OF MAXIMAL DEVIATION		No. of cases
COTTLE'S AREA 1	VESTIBULAR	13
COTTLE'S AREA 2	VALVULAR	33
COTTLE'S AREA 3	ATTICAL	21
COTTLE'S AREA 4	MEDIAL TURBINAL	28
COTTLE'S AREA 5	POSTERIOR TURBINAL/ CHOANAL	5

Overall anterior deviations (areas 1,2 and 3) are common. 67 patients had anterior deviations(n=100)

Chart 23: Nasal mucousa



62 patients had pale nasal mucousa, 8 had congested mucousa, mucousa was normal looking in 30 cases

RESULTS

One hundred and eight allergic patients underwent septoplasty during the study period. Follow-up data were obtained from one hundred patients. Eight patients either failed to turn for follow up or developed complications. Therefore complete data were available for 100 subjects. Of the 100 patients studied, 10 patients fell under Mild intermittent group, 40 in Moderate-severe intermittent, 38 in Mild persistent group, 12 under Moderate- persistent group according to the ARIA guidelines. [50,51]

Following septoplasty a decrease in NOSE score was observed in all patients except for one which showed an increase. Pre operative NOSE score was distributed as Mild intermittent(mean 15.7, sd 1.252) Moderate-severe intermittent(mean 15.95, sd 1.839) Mild persistent(mean 16.1, sd 1.189) Moderate- severe persistent(mean 16.3, sd 0.965) and the post operative scores recorded at the end of one month following septoplasty were Mild intermittent (mean 9.6, sd 0.699) Moderate- severe intermittent(mean 9.65, sd 0.662) Mild persistent(mean 9.55, sd 0.645) Moderate- severe persistent(mean 9.42, sd 0.900). The mean decrease in NOSE score following septoplasty was in Mild intermittent(6.1), Moderate-severe intermittent(6.3), Mild persistent(6.55), Moderate- severe persistent(6.88). The mean decrease in NOSE score following septoplasty overall was (pre-operative 16.03, postoperative 9.58, $p<0.001$) analysed to

be statistically significant (significant at 1% level, 99% CI). This clearly shows that in allergic patients with deviated nasal septum, irrespective of the allergic status septoplasty significantly improves the nasal obstruction as shown by the decrease in NOSE score to a statistically significant extent.

ARCT scores were recorded pre operatively and at the end of two months post operatively and results were analysed. Pre operative score was (mean 12.77 ± SD 1.024) and the post operative score (mean 21.8 ± SD 0.914) with p value < 0.001, significant statistically at 1% level, 99 % CI. This clearly shows that in allergic rhinitis patients with symptomatic deviated nasal septum, septoplasty improves the quality of life pertaining to allergy to a statistically significant extent.

DISCUSSION

Based on the prementioned data from subjective measurements, a conclusion with major impact on patient management is reached. Coexistence of allergic rhinitis with nasal septum deviation seems to place patients in a less favourable prognostic group as far as surgical outcome and patient satisfaction are concerned. This conclusion is similar to the usual, undocumented, clinical observation that patients without allergic rhinitis undergoing septoplasty tend to be more satisfied post-operatively. Other authors such as Stewart et al.[5] have found that patient satisfaction following septoplasty did not correlate with their allergic rhinitis. Bohlin et al [59] have shown that after proper patient selection, based on active rhinomanometry and anterior rhinoscopy, 84% of the patients were satisfied 10 years post-operatively, while the decrease in nasal resistance after the operation remained the same after 10 years[60].

The most common complaint in rhinologic practice is difficulty in nasal breathing, and nasal septal deviation and allergic rhinitis are among the common causes.[61] The clinician often faces therapeutic dilemmas when managing a patient who suffers from both these entities. In such cases, when the deviated septum completely obstructs the nasal chamber the answer is obvious. When

the deformity is less pronounced, on the other hand, the therapeutic decision is more complex. Unfortunately history and physical examination, although imperative, are usually not sufficient to provide a definite answer.[62]

In general, available diagnostic tools can be categorized as subjective, including patient history, the Nasal Obstruction Evaluation Scale (NOSE) [63], questionnaires incorporating a visual analogue scale[64], the Fairly nasal symptom score, the Nottingham health profile and the General health questionnaire[65,66], and objective, such as rhinomannomertry, acoustic rhinometry[67], computed tomography and peak inspiratory nasal flow[68].

In the present study, in order to assess subjective symptoms we employed the Nasal Obstruction Symptom Evaluation (NOSE) Scale, which is a disease-specific quality of life instrument for use in nasal obstruction, developed by Stewart et al[63]. Its major advantage is that it is superior to history in evaluating the subjective symptoms in the most accurate possible way with regard to difficulty in breathing, whereas other scales, such as the Fairley nasal symptom score, are not equally reliable[64]. For objective assessment of nasal patency, methods such as active anterior rhinomanometry, posterior rhinomanometry or passive rhinomanometry are used by a

number of investigators to document the pre to post –operative reduction in mean airway resistance values in patients who underwent septoplasty[69,70,71,72]. However examinations such as rhinomanometry, acoustic rhinometty or peak inspiratory nasal airflow have not been incorporated into our study, because of non-availability.

The best management of patients with nasal septal deviation is still under debate. There are no evidence-based guidelines for which patients to operate on and which patients will benefit the most. Treatment of choice for nasal septal deviation is septoplasty, although other surgical techniques, such as submucous resection, have been used with less favourable results[73]. Septoplasty is one of the most frequently performed surgical procedures in otorhinolaryngology and its selection relies largely on clinical judgement alone. Practice based on experience alone is not regarded satisfactory neither from a scientific nor from a legal point of view. A significant number of patients report to be less satisfied following surgery, thus providing proof of the limitations of clinical selection criteria[74]. The initial improvement of nasal ventilation felt in the first months or years after surgery is progressively devaluated by the patients with the passing of time, particularly if other causes for nasal obstruction,

such as chronic rhinitis and rhinosinusitis, also coexist[75]. On the other hand, some investigators believe that, regardless of the magnitude of septal deviation, most patients benefit from its surgical correction because it eliminates a possible contributing factor to the pathogenesis of chronic rhinosinusitis[76]. Nevertheless, inappropriate selection of surgery as a therapeutic option and inappropriate choice of surgical modality do seem to be major causes for dissatisfaction[77].

Allergic rhinitis(AR) significantly reduces quality of life (QOL), interferes with both attendance and performance at school and work[78,79] and results in substantial financial costs[80]. AR is common and affects over 20% of the population. The prevalence of AR has increased over the last three decades[81]. Subjects at most risk are those with atopy, with a family history of rhinitis, first-born children and immigrants[81]. AR is the predominant form in children, but accounts for about a third of rhinitis in adults. Treatment of allergic rhinitis consists of patient education, allergen avoidance, pharmacotherapy, immunotherapy and surgery. The latter mainly aims at the reduction of the inferior turbinates[1,3].

The statistically significant decrease in NOSE score in the allergic rhinitis patients with symptomatic deviated nasal septum proves

that septoplasty is to be strongly considered an option in case of symptomatic deviated nasal septum even in the presence of allergic rhinitis. as found in the present study, in contrast with clinical experience that has been previously documented[82] which may be attributed to the fact that regardless of the final surgical outcome, patients with allergic rhinitis may exhibit more crusting, swelling and discomfort during the early post-operative period or may need additional medication to control their allergy. Another feasible explanation would be the wrong attribution of symptoms by the clinician to the deviated septum pre-operatively when in fact these symptoms are more related to allergic status.

The study also clearly brings out the fact that septoplasty when performed in allergic rhinitis patients with deviated nasal septum improves the allergic rhinitis status. Based on previous studies by Kim YH et al.[8] which employed rhinasthma score to evaluate the improvement in allergic rhinitis by doing only turbinoplasty in one group and septoplasty with turbinoplasty in the other group shows that septoplasty when combined with turbinoplasty is more effective in relieving the allergic status. Sixty-two patients who had undergone septoplasty and turbinoplasty for septal deviation and allergic rhinitis were enrolled in group A. Twenty-six patients who had undergone only turbinoplasty for allergic rhinitis were

enrolled in group B. The VAS score, the Average Rescue Medication Score (ARMS), and the Rhinasthma Questionnaire for the quality of life were all obtained from each patient. These parameters were compared before and after the surgery and between the groups. Both groups showed significant improvement of the VAS score ($P < .001$). When the change of VAS was compared between groups, there was a significant difference in group A only for nasal obstruction ($P = .047$). Comparison of the ARMS between groups showed significant improvement in both groups after the surgery ($P < .01$). However, there were no differences between the groups. The Rhinasthma score of group A was significantly lowered after the surgery (56.4 ± 13.2 to 34.1 ± 12.3, $P < .001$). The Rhinasthma score of group A was significantly lower than that of group B after the surgery ($P = .004$).

In our study we employed the allergic rhinitis control test questionnaire developed by Demoly P et al. [7] for evaluating the control of allergic rhinitis following septoplasty. The self-assessment score for allergic rhinitis control appeared to be sensitive to change and correlated to the clinical expression of rhinitis and also to its involvement with treatment. These results suggest that this self-completion questionnaire could be used in daily practice at each consultation to determine, in a standardized manner, the level of control of the allergic rhinitis of an

individual patient. P value <0.0001.[7] Our study results clearly shows that in allergic rhinitis patients with symptomatic deviated nasal septum, septoplasty improves the quality of life pertaining to allergy to a statistically significant extent with p value <0.001.

LIMITATIONS

A major limitation of this study is that it is a short study with one year study period and a limited follow up of two months following surgery. The evaluation of NOSE score to assess the improvement in nasal obstruction following septoplasty is done at the end of four weeks post operatively and compared with the pre operative score for results may account in both ways. First, since it is the early post-operative period and healing of the surgical wound is still under way, patients may have scored better in the NOSE questionnaire if they were examined after a longer period. On the other hand, the post operative time of four weeks is generally considered enough to judge the surgical outcome and longer periods of follow-up have not shown significant differences in patient satisfaction[83]. Another weakness of the study is that it is purely based on subjective parameter (NOSE Scale), and objective methods or other diagnostic tools such as rhinomanometry, acoustic rhinometry or peak inspiratory nasal flow measurement is not employed.

Similarly, the allergic rhinitis control test questionnaire (ARCT) is evaluated at the end of two months following surgery and compared with pre operative score with the improvement in the score following surgery being taken as the effect of septoplasty on allergic rhinitis. This study

definitely shows that septoplasty when done in indicated cases with allergic rhinitis clearly has a positive impact, with statistically significant improvement in allergic rhinitis status two months following surgery. However a long term follow-up is necessary to throw more light on the control of allergic rhinitis and improvement in the quality of life following septoplasty.

CONCLUSION

Based on the prementioned data from subjective measurements, a conclusion with major impact on patient management is reached. It is said in many studies that coexistence of allergic rhinitis with nasal septum deviation seems to place patients in a less favourable prognostic group as far as surgical outcome and patient satisfaction are concerned. Several undocumented clinical observations show that patients without allergic rhinitis undergoing septoplasty tend to be more satisfied post-operatively. Other authors such as Stewart et al.[5,63] have found that patient satisfaction following septoplasty did not correlate with their allergic rhinitis. Bohlin et al [70] have shown that after proper patient selection, based on active rhinomanometry and anterior rhinoscopy, 84% of the patients were satisfied 10 years post-operatively, while the decrease in nasal resistance after the operation remained the same after 10 years[84]. The present study suggests that in allergic rhinitis patients with symptomatic deviated nasal septum or in other words septoplasty performed in allergic rhinitis with coexistent deviated nasal septum not only improves the nasal obstruction significantly, but also there is a remarkable improvement in the control of allergic rhinitis following surgery.

RECOMMENDATIONS

1. The study undeniably shows that septoplasty when done in allergic patients with symptomatic deviated nasal septum in contrary to the popular belief, results in a significant improvement in nasal obstruction.

2. The study also brings to light that in allergic patients with coexistent deviated nasal septum undergoing septoplasty, there is a remarkable control in allergic status following surgery with signifiacant reduction in the usage of anti allergic medications as well as improvement in the quality of life .

3. Adequate medical management of allergic rhinitis should be the first priority for these cases to obtain maximum results.

4. Treatment for allergic rhinitis should be continued following the correction of nasal septal deviation for satisfactory outcome.

5. Further studies are necessary to validate the long term control of quality of life and of symptoms of allergic rhinitis following surgery.

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TEXTBOOK REFERENCE

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ANNEXURE I

NOSE SCALE

ID# _____ Date _____

Nasal Obstructive Symptoms Evaluation Scale

→ To the Patient: Please help us to better understand the impact of nasal obstruction on your quality of life by completing the following survey. Thank you!

Over the past 1 month, how much of a problem were the following conditions for you?
Please Circle the Most Correct Response

	Not a Problem	Very Mild Problem	Moderate Problem	Fairly Bad Problem	Severe Problem
1. Nasal congestion or stuffiness	0	1	2	3	4
2. Nasal blockage or obstruction	0	1	2	3	4
3. Trouble breathing through my nose	0	1	2	3	4
4. Trouble sleeping	0	1	2	3	4
5. Unable to get enough air through my nose during exercise or exertion	0	1	2	3	4

6. Please mark on this line how troublesome is your difficulty in breathing through your nose:

None — Medium — Severe

Stewart, Michael G., et al. *Otolaryngology--Head and Neck Surgery* 130.2 (2004): 157-163.

ANNEXURE II

ALLERGIC RHINITIS CONTROL TEST (ARCT) QUESTIONNAIRE

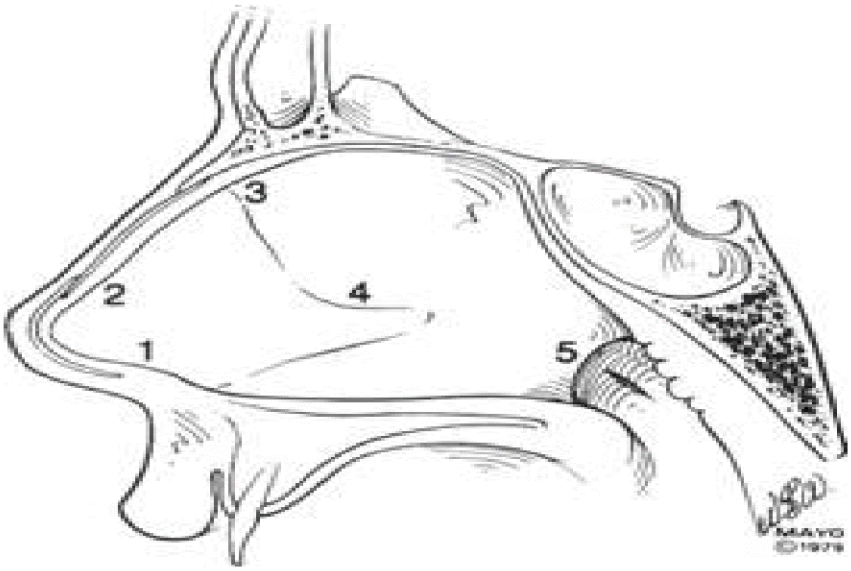
Allergic rhinitis control test

During the last 2 weeks, has your allergic rhinitis had an effect on your professional/personal activities?					
Permanently	Very often	Often	Not often	Never	Points
1	2	3	4	5	
During the last 2 weeks, has your allergic rhinitis made you irritable?					
Permanently	Very often	Often	Not often	Never	Points
1	2	3	4	5	
During the last 2 weeks, has your allergic rhinitis disturbed your sleep (going to sleep, waking at night)?					
Permanently	Very often	Often	Not often	Never	Points
1	2	3	4	5	
During the last 2 weeks, have you needed to use an additional treatment not prescribed by your doctor to treat your allergic rhinitis?					
Four nights or more per week	Two to three nights per week	One night per week	One to two times in all	Never	Points
1	2	3	4	5	
During the last 2 weeks, how would you assess your allergic rhinitis?					
Not controlled at all	Very slightly controlled	Somewhat controlled	Well controlled	Completely controlled	Points
1	2	3	4	5	
Total score					

P. Demoly et al. Clinical & Experimental Allergy, 41 : 861

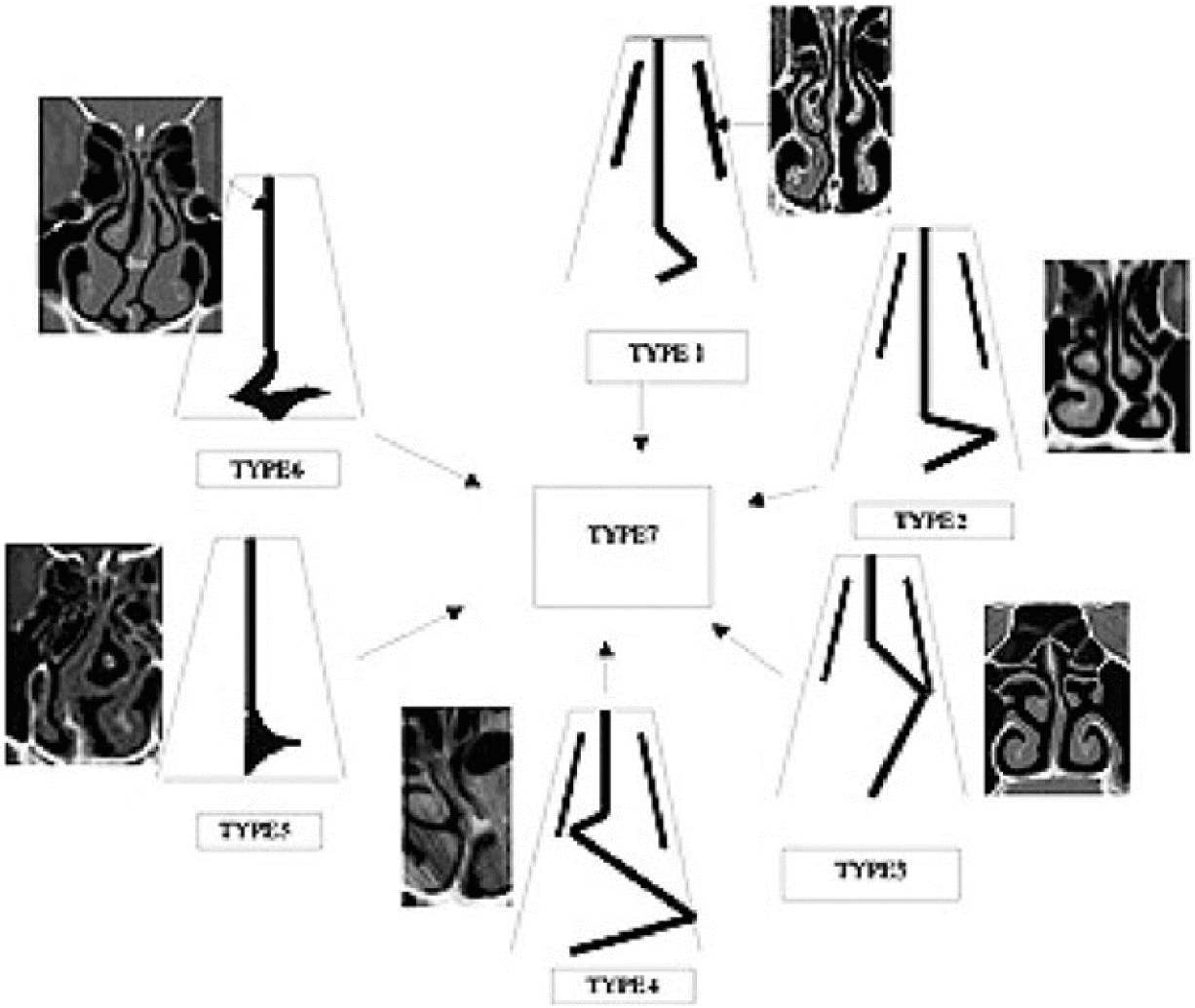
ANNEXURE III

COTTLE'S AREA



ANNEXURE IV

MLADINA'S CLASSIFICATION OF SEPTAL DEVIATIONS



ANNEXURE V

DIAGNOSTIC NASAL ENDOSCOPY PROFORMA

DIAGNOSTIC NASAL ENDOSCOPY PROFORMA
Govt. Rajaji Hospital, Madurai
Department of ENT

Name: Age / Sex :
IP/OPNo. Date :
Indications :
Headache :
Nasal block :
Nasal discharge :
Epistaxis :
Anosmia :
Sneezing :
Scope(s) used : 0° / 30° / 45°

I – Pass Nasal mucosa Inferior turbinate Inferior Meatus ET – orifice Nasopharynx Fossa of Rossenmuller		
II – Pass Nasal mucosa Superior Turbinate / Meatus Supreme Turbinate / Meatus Spheno ethmoidal Recess Sphenoid ostia		
III – Pass Nasal Mucosa Middle Turbinate Middle Meatus Uncinate Bulla Hiatus Accessory Ostia		
Nasal septum & Mucosa		

Conclusion :

Advice :

ANNEXURE VI

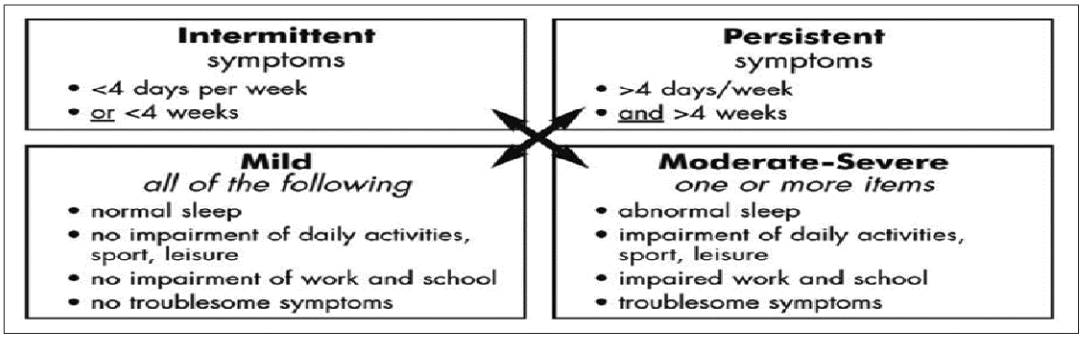
Standard criteria - Allergic Rhinitis And its Impact on Asthma (ARIA) guidelines 2007

SYMPTOMS SUGGESTIVE OF ALLERGIC RHINITIS

- Watery anterior Rhinorrhoea
- Sneezing, paroxysmal
- Nasal obstruction
- Nasal itching
- ± conjunctivitis

2 or more of the symptoms >1hour on most days

CLASSIFICATION



Bousquet J, Van Cauwenberge P, Khaltaev N. Allergic rhinitis and its impact on asthma (ARIA). J Allergy Clin Immunol, 2001; 108: 5174-5334.

EFFECT OF SEPTOPLASTY ON ALLERGIC RHINITIS

- STUDY PROFORMA

NAME **IP NO.**

AGE

SEX

1	MALE
2	FEMALE

COMPLAINTS	**ABSENT**	**PRESENT**
NASAL OBSTRUCTION	0	1
ALLERGIC SYMPTOMS*	0	1
HEADACHE	0	1
POST NASAL DRIP	0	1
NASAL BLEED	0	1
SMELL DISTURBANCE	0	1
SNORING	0	1
FACIAL PAIN	0	1

*WATERY ANTERIOR RHINORHHOEA ± SNEEZING (VIOLENT AND IN BOUTS) ± NASAL ITCHING ± CONJUNCTIVITIS (RED, ITCHY EYES)

ALLERGIC STATUS	INTERMITTENT	PERSISTENT
MILD	1	3
MODERATE- SEVERE	2	4

ANTERIOR RHINOSCOPY	**0**	**1**	**2**	**3**
SIDE OF MAXIMAL	NA	RIGHT	LEFT	NA

DEVIATION				
CAUDAL DISLOCATION	ABSENT	RIGHT	LEFT	NA
SPUR	ABSENT	RIGHT	LEFT	BILATERAL
TURBINATE HYPERTROPHY	ABSENT	RIGHT	LEFT	BILATERAL

NASAL ENDOSCOPY

SITE OF MAXIMAL DEVIATION	
COTTLE'S AREA 1	VESTIBULAR
COTTLE'S AREA 2	VALVULAR
COTTLE'S AREA 3	ATTICAL
COTTLE'S AREA 4	MEDIAL TURBINAL
COTTLE'S AREA 5	POSTERIOR TURBINAL/ CHOANAL

MUCOUSA	
1	NORMAL
2	PALE
3	CONGESTED

TURBINATE HYPERTROPHY	
0	ABSENT
1	RIGHT
2	LEFT
3	BILATERAL

CT PNS	
TYPE 1	MILD DEVIATION IN VERTICAL PLANE
TYPE 2	MODERATE ANTERIOR VERTICAL DEVIATION
TYPE 3	POSTERIOR VERTICAL DEVIATION
TYPE 4	S -SHAPED, POSTERIOR TO ONE SIDE , ANTERIOR TO OTHER
TYPE 5	HORIZONTAL SEPTAL CREST TOUCHING OR NOT TOUCHING THE LATERAL WALL
TYPE 6	PROMINENT MAXILLARY CREST CONTRALATERAL TO THE DEVIATION WITH A SEPTAL CREST ON THE DEVIATED SIDE
TYPE 7	COMBINATION OF PREVIOUSLY DESCRIBED SEPTAL DEFORMITY TYPES

ABSOLUTE EOSINOPHIL COUNT

NOSE SCORE (TOTAL SCORE 20)	
BEFORE SURGERY	
AFTER SURGERY	

ARCT SCORE(TOTAL SCORE 25)	
BEFORE SURGERY	
AFTER SURGERY	

INFORMED CONSENT FORM

Study Title: EFFECT OF SEPTOPLASTY ON ALLERGIC RHINITIS.

Subject Initials:

Subject Name:

Date of birth/Age:

1. I confirm that I have read and understood the information sheet dated for the above study and have had the opportunity to ask questions
2. I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected
3. I understand that the investigator of the clinical study, others working in the investigator's behalf, the ethics committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that maybe conducted in relation to it, even if I withdraw from the trial. I agree to this access. However I understand that my identity will not be revealed in any information released to third parties or published.
4. I agree not to restrict the use of any data or results that arise from this study period provided such a use is only for scientific purpose(s)
5. I agree to take part in the above study

Signature of the subject/Legally acceptable representative

Date:

Signatory name:

Signature of the investigator: **Date:**

Signature of the witness: **Date:**

MADURAI MEDICAL COLLEGE
MADURAI, TAMILNADU, INDIA -625 020
(Affiliated to The Tamilnadu Dr.MGR Medical University, Chennai, Tamil Nadu)

ETHICS COMMITTEE CERTIFICATE

Name of the Candidate	:	Dr.N.Raghuram
Course	:	PG in M.S., Otorhinolaryngology
Period of Study	:	2015-2018
College	:	MADURAI MEDICAL COLLEGE
Research Topic	:	Effect of septoplasty on allergic rhinitis
Ethical Committee as on	:	17.03.2017

The Ethics Committee, Madurai Medical College has decided to inform that your Research proposal is accepted.

Member Secretary

Chairman
Prof Dr V Nagaraajan
M.D., MNAMS, D.M., Dsc.,(Neuro), Dsc (H)
CHAIRMAN
IEC - Madurai Medical College
Madurai

Dean / Convenor
DEAN
Madurai Medical College
Madurai-20

URKUND

Urkund Analysis Result

Analysed Document: AdminPLAGIARISM WEB TOOL.docx (D31252272)
Submitted: 10/12/2017 1:51:00 PM
Submitted By: raghuramnataraj@gmail.com
Significance: 8 %

Sources included in the report:

8 Bipin Sethumadhavan.pdf (D17227315)

Instances where selected sources appear:

23